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ABSTRACT

Designed as a resource for members of the World Health Organization, this guide on competency-based curriculum development in medical education may be applied to programs for other health professions and occupations. An explanation of subject-centered curricula and integrated curricula is offered, and ways in which these models differ from competency-based medical education are discussed. Identifying the elements of competence involves an analysis of: physicians' activities through self-reports, observation, and task analysis; analysis of critical incidents and expert judgment; and analysis of health care needs based on public health statistics, medical records, and social, economic, and political realities. A model is presented to evaluate professional performance through consideration of the client, the problem, and the setting. Three themes are discussed that are important in determining the nature and organization of student learning experiences: time, sequence, and mastery learning. Entry, formative, and summative assessment of competence are covered. New educational roles for the teacher and the student and strategies for curriculum change are also addressed. (SW)

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COMPETENCY-BASED CURRICULUM DEVELOPMENT IN MEDICAL EDUCATION: An Introduction

W. C. McGAGHIE, G. E. MILLER,
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PUBLIC HEALTH PAPERS

No. 68

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An Introduction

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An Introduction

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FOREWORD

Writing a book that will be useful to all 150 Member States of the World Health Organization is a formidable undertaking at best. When the topic is curriculum development for the health professions, the difficulty is compounded not only by the strong feelings associated with educational traditions, but also by the very different needs, opportunities, and resources among WHO Members.

We have attempted to deal with this problem by emphasizing the process of curriculum construction rather than its content. While we are persuaded that the most significant health problems for whose solution young professionals must be prepared are those relating to communities and the preservation of health, rather than to individuals and the cure of disease, nevertheless we are not prepared to suggest that these are the only competencies toward which medical education should be aimed. If we have achieved the balance for which we strived then the protagonists for neither view will be satisfied that we have given their particular concern sufficient attention.

Our hope is that whatever their present views about the content and emphasis required in medical education, readers will be willing to examine the process set forth here as a point of reference against which to test the conclusions about curriculum they may have reached through other means. If any significant number gain new insight into what may be required to improve curriculum design, we will be satisfied that the first objective of this volume has been realized.

The second, however, is more difficult to achieve. Despite an effort to be precise and concrete, not general and abstract, the translation of principles and procedures described here into the curriculum practices of any school will not be easy. For the simple fact is that most medical teachers have been trained to think or to act not as educators so much as content experts who are charged with teaching responsibilities. The task of helping staff members of schools for health professionals to acquire the necessary knowledge and skills to improve the quality of education is one to which WHO has given steadily increasing attention by

encouraging and supporting regional and national teacher training centres. We acknowledge the need for enhancing professional competence in education as a desirable adjunct to the implementation of the curriculum concepts embodied in this volume. But we have not been able to deal with these issues and still keep the book to manageable size. Readers who feel a need for assistance in this realm may wish to consult other WHO publications, notably in the Public Health Papers *series.*

While the principal focus of this volume is medical education, since that is the discipline in which the authors have had their greatest experience, the solution of curriculum problems in the education of other health workers is equally important in the production of practitioners who can meet the health needs of the contemporary world. Thus it is worth noting that the principles embodied here are not limited in their application to medical education but have general usefulness. It is our hope that representatives of these other health professions and occupations will also find them helpful.

With these disclaimers we wish our readers a pleasant and profitable journey through this volume.

W. C. McG.
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T. V. T.

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CHAPTER 1

CURRICULUM MODELS

It must be evident to any objective observer that the practice of medicine becomes increasingly complex with each passing year. Technological advances and research findings leading to improved methods of disease prevention, diagnosis and treatment produce a constantly changing definition of the competence a medical student must acquire. Equally important, although less often articulated as a determinant of competence, is the setting in which a graduate will work. The knowledge and skills needed to meet health service needs in a developing country (e.g., Rwanda, where the ratio of physicians to population has been estimated at 1:90 500[1]) are very different from those needed in an industrialized country such as the United Kingdom. In the former, the most important element of professional competence may be the physician's ability to train a team that will handle most of the direct patient care load, and to manage a system that serves the public health. In the latter, professional competence is usually judged by the physician's ability to provide personal care for individual patients.

Given the exponential growth of medical information and clinical skills and acknowledging that the roles and functions of the doctor will vary according to the patient care setting, medical schools and other institutions responsible for the education of health professionals face a serious dilemma. On the one hand, there is a legitimate expectation that graduates will be proficient in the latest and most advanced techniques for preserving health and managing disease. This expectation is coupled with the belief that a thorough foundation in the basic and clinical sciences is a fundamental prerequisite for achieving that goal. On the other hand, concern for assuring academic quality in these sciences must not divert attention from the competence required to meet the real health needs of people. It is a rare school that has seemed successful in resolving this dilemma. For example:

[1] *WHO Chronicle*, **30**: 32 (1976).

"A study of general practitioners in ... shows an *inverse* correlation between the frequency of disease and the emphasis given to instruction about diseases during medical training." [1]

"The general attitude among the staff is that university education consists of 'the learning, remembering, and reproducing of the information in the books or the notes'. Such archaic views are so predominant among the older and senior staff that one could easily believe the report that they objected to extension into the evenings of the opening hours of the university library for the use of students as an unnecessary move!" [2]

"In ... the teaching of the preclinical subjects has not been organized in an atmosphere of research, with the result that the students' powers of observation and of drawing deductions from such observation are not adequately stimulated. Nor is the practical application of the preclinical subjects brought home to the students. The transition from preclinical to clinical studies is abrupt. The student in the period of clinical training does not have to apply anatomy and applied physiology taught to him by his preclinical professors. The preclinical and the clinical portions of the course lie side by side instead of being integrated, though each with its own emphasis: the former on scientific research and the study of the subject for its own sake rather than for its application to the treatment of disease, and the latter on the treatment of disease itself." [3]

"Students in ... receive rigorous training in the [European] tradition including instruction in sophisticated diagnostic and patient management techniques. However, a district hospital, where one physician with the help of a trained nurse and a handful of auxiliaries care for over 100 000 people, may have no X-ray, running water, or operating theater, and medication of any variety is scarce." [4]

Such illustrations highlight the discrepancy that often exists between medical curricula and the functional requirements of medical practice, but give little insight into underlying causes. In many parts of the world, but particularly in nations with a history of colonial influence, one important reason is tradition. Not only are medical curricula commonly based on foreign models, but also academic degree and specialty certification requirements are often established by external agencies. A second cause may be the isolation of many medical schools from the clientele their graduates should be expected to serve. Predominantly located in major urban areas, very few appear to provide significant student contact with rural people, who have the greatest health care needs and the fewest health care facilities. A third possibility stems from what seems to be a primary interest of the most prominent medical teachers: understanding human disease, rather than preserving human

[1] HODGKIN, K. *Towards earlier diagnosis.* Edinburgh, Livingstone, 1966.

[2] ZAMIRI, I. A personal view of recent medical and educational developments in Iran. *British journal of medical education,* **5**: 75 (1971).

[3] NAYAR, D. P. Undergraduate medical education in India. *British journal of medical education,* **5**: 172 (1971).

[4] BRYANT, J. *Health and the developing world.* Ithaca, NY, Cornell University Press, 1969.

health. Certainly the infrequency of opportunities for students to study preventive medicine or to engage in projects designed to enhance the public health is in striking contrast to the regularity of experiences with diagnostic and therapeutic medicine. There are probably other explanations for the apparently low correlation between what is taught in medical schools and what is most needed for medical practice but none of these, taken singly or in combination, should perpetuate educational programmes in which medical competence is defined largely by academic proficiency with books or written tests rather than by the practical ability to meet human needs.

While admittedly painted with a broad brush the picture sketched thus far would provoke a sharply negative response to the question: "Is the current medical curriculum a *valid* expression of optimal professional practice?" The more important question is: "How, then, can things be changed?"

The most common method of curriculum change has been to revise content while preserving the subject-centred structure. Two major alternatives also demand a wider hearing. The first is an integrated programme model where learning and teaching attempt to fuse formerly separate medical disciplines by using, for example, organ systems or medical problems as the organizing structure. The second arranges learning and teaching around the functional elements of medical practice. Because the emphasis is on learning how to practise medicine, not on accumulating knowledge about medical practices, it is called competency-based. But before any school can make a sound decision about which of these three options might yield the most appropriate curriculum plan, it is necessary to understand the reasoning that underlies their development and use, and the assumptions each makes about the practice of medicine and how students should be prepared to engage in that craft.

SUBJECT-CENTRED CURRICULUM

The subject-centred curriculum is the most widespread model for medical education. It generally includes 2–4 years of didactic instruction in basic and preclinical science, followed by several years of instruction in the clinical disciplines, including varying amounts of practical work. Three to 6 years of additional study are commonly required if qualification in a medical or surgical specialty is sought. This model assumes that physicians must be scientifically oriented and that they need an extensive introduction to the biological and physical sciences prior to controlled clinical experience. Large doses of scientific fact

and theory, together with instruction in research methodology, are provided through discrete courses that cover such classical subjects as physics, chemistry, anatomy, physiology, and pathology, as well as more recent additions such as immunology and biostatistics. The emphasis is on learning the disciplines rather than their application to the practice of medicine. Contact with patients occurs only after proficiency in these sciences is demonstrated, usually through end-of-course or end-of-year written examinations.

All students study the same material, in the same setting, within the same time frame. An implicit assumption is that given, for example, 14 weeks of classroom lectures complemented by intense study outside class, students can become proficient in a basic science such as biochemistry. This is a dubious assumption for two major reasons. First, because faculty and students rarely have a clear and explicit understanding of what is meant by a functional proficiency in biochemistry. Consequently, both class sessions and outside assignments are oriented to books and tests, not functional applications. Secondly, setting a fixed time for any course implies that all students learn in the same manner and at the same rate, a presumption rejected long ago by students of human learning.

The ensuing clinical experience, while separate from the classroom and laboratory work in basic science courses, is often taught by the same methods. The principal instructional difference is in the opportunity students have to see patients, and occasionally to work with them. Yet separation among the clinical disciplines is as sharp as that found in preclinical instruction. Surgery, medicine and psychiatry, for example, are taught as separate subjects, and not as tools for understanding the undifferentiated problems which patients present to medical practitioners.

Students are exposed to patients primarily in a teaching hospital stocked with the best available equipment, medication and personnel. Such hospitals are usually populated with patients suffering from complex or unsolved medical problems. Thus clinical instruction tends to emphasize diagnosis and management of the unusual, not the most frequent patient complaints. Indeed, rare or unexpected disorders seem to attract the most attention from teachers and students alike. In the face of such experience and models it should not be unexpected if students become indifferent to, and have limited skill in managing, the common problems that will occupy a major portion of their later professional lives.

This observation should not be taken to suggest that such hospitals or the professional services they provide are undesirable. It merely indicates that a subject-centred curriculum is an almost inevitable consequence when instruction is controlled by basic and clinical scientists

who see medicine as a series of independent disciplines which in sum represent the modern doctor's work. The nature of the scientist's work inevitably limits perspective and many are incapable of seeing the contribution each course or clinical experience might make to the daily requirements of medical practice outside the training sites. Caught up in the task of dealing with difficult, frequently insoluble but always challenging problems of disease, they have little time or energy left to think about the preservation of human health through modifying environmental hazards, social conditions, and human ecology in general. The result is an educational programme in which the practice of medicine is mortgaged to the study of medicine, a series of exercises divorced from the realities of providing care for those most in need.

The challenge to improve health care and the corresponding need to improve education for the health professions is beginning to highlight these limitations of the subject-centred curriculum model. In developing nations, where the need is greatest, attempts to modernize medicine, to improve general health standards, and to train practitioners at all levels in a manner that relates their work to indigenous sociocultural needs are increasingly evident. Industrialized nations, struggling with acute shortages of competent health manpower, an uneven distribution of medical practitioners, and urban decay are exerting pressure on health science institutions to modify the education they offer to meet these problems. The most common response has been revision of curriculum content to reflect the latest research findings or clinical techniques. Courses and disciplinary distinctions are preserved, while change is seen mostly in new course syllabi, textbooks, audiovisual materials, or time allotments. Such modifications are surely expected of any first-rate faculty irrespective of the curriculum model being used, but revising course offerings while maintaining a subject-centred format produces primarily cosmetic change; only rarely does it bring medical education closer to the work of practising physicians.

As an example, Table 1 shows the 1950–1958 and 1969–1970 distribution of instructional time at one university in the United Kingdom. While there is a pronounced reduction in the number of hours devoted to anatomy and more time is given to such subjects as biology, medical physics, physiology, and mental health, the emphasis is still on departmental offerings, despite the introduction of some integrated instruction, topic teaching, and elective offerings that are not shown in the table.

Whatever its scientific merit, the subject-centred curriculum model has undesirable consequences for medical students, their future patients, and the institutions responsible for training health care personnel. For students, this traditional organization of medical education emphasizes factual knowledge of independent medical disciplines, lockstep instruc-

TABLE 1. APPROXIMATE DISTRIBUTION OF TIME (HOURS) IN A MEDICAL CURRICULUM[a]

Subject	1950–1958	1969–1970	Increase or decrease
Biology	210	240	+30
Chemistry	250	210	−40
Physics and medical physics	245	310	+65
Genetics	20	20	0
Statistics	20	40	+20
Orientation course	0	20	+20
Anatomy	910	595	−315
Physiology	260	350	+90
Biochemistry	170	140	−30
Human ecology	0	30	+30
Medical psychology	20	10	−10
Pharmacology	165	110	+ 5
Therapeutics		60	
Pathology	230	270	+40
Bacteriology	70	85	+15
Public health/social medicine	85	48	−37
Forensic medicine	50	26	−24
History and philosophy of medicine	15	0	−15
Mental health	95	100	+ 5
Dermatology	35	24	−11
Ophthalmology	35	30	− 5
Venereal diseases	35	7	−28
Diseases of ear, nose and throat	35	24	−11

[a] Based on: MCANDREW, G. M. ET AL. The undergraduate curriculum in retrospect. *British journal of medical education*, **4**: 294, Table 2 (1970) (by permission).

tion, patient contact without direct responsibility for patient care, attention to the less common clinical problems, and an implicit focus on human disease—not health. Consumers of medical services suffer because such a curriculum prepares health workers according to disciplinary, rather than community expectations. In institutions, it promotes professional insularity rather than involvement with the most pressing problems of health manpower and systems of health services.

INTEGRATED CURRICULUM

The integrated curriculum attempts to fuse independent disciplines into a more unified whole. Development of this model was based on the assumption that medical learning and teaching gain greater meaning when didactic courses and clinical experience are brought together, an assumption supported by recent research on human learning and memory.[1] This does not mean that isolated fragments of information

[1] AUSUBEL, D. P. *Educational psychology: a cognitive view*. New York, Holt, Rinehart & Winston, 1968.

cannot be learned; they are learned regularly in many formal educational programmes. However, their retention and use is another question. In one study, where the same tests were administered to medical students at the end of basic science courses and again 1, 2 and 3 years later, the results showed remarkably little retention of what had been acquired. Disappointingly few students remembered enough to pass the original courses again.[1] In fact the forgetting curves were similar to those reported in the nineteenth century for the retention of nonsense syllables.

Integrating curriculum elements into a conceptually meaningful structure is one way to overcome the problem of instruction presented in the form of separate subjects. Advocates of the approach argue that courses organized around major organ systems (e.g., cardiovascular, gastrointestinal, genitourinary) provide a more appropriate context for learning about medicine. Within each course students study the biological and chemical foundations of an organ system, its structural properties, reactions to disease and injury, and response to treatment. If relevant experience of patient care can be provided at the same time, educational impact is further heightened.

Such principles were the basis for the then revolutionary curriculum instituted at Case Western Reserve University's School of Medicine at Cleveland, Ohio, in the early 1950s. Organ system instruction coupled with an institutional commitment to correlate the basic sciences with clinical experience represented a striking contrast to the subject-centred model which then, as now, dominated medical education. Although greeted with considerable scepticism the model has now been adopted in whole or in part by many other medical schools.

A variation of the integrated model is the core curriculum. Here a set of fundamental courses representing the essential foundations of medicine in general, or a medical specialty in particular, is offered to all students before more individualized opportunities for focused study are presented.

One of the most exciting examples of such a curriculum is now being offered in Mexico City at the Autonomous Metropolitan University, Xochimilco. In January 1975, 800 students in biological sciences and health and social sciences and humanities began their studies on this satellite campus with a basic core programme that encompassed three primary areas: (1) common sense and scientific method; (2) normality and abnormality; and (3) labour and the labour force.

Upon completing this common experience the two groups separated for additional core work more directly related to their specific areas

[1] Office of Research in Medical Education. *Report to the Faculty*. Chicago, IL, University of Illinois College of Medicine, 1961 (unpublished document).

of interest. For example, the biological sciences and health group had a core module dealing with cellular biology in which gastroenteritis (*not* gastroentero'ogy) was used as a working example around which key anatomical, biochemical and pathological concepts were developed. During a subsequent academic term another core module dealt with energy and energy consumption, using nutrition as the illustrative content area. In the second year the biological sciences and health group further divided into health sciences, veterinary medicine and agronomy, and biological sciences. In the ensuing year the health sciences group subdivided into medicine, nursing, and dentistry cohorts.

It should be clear that the core in this instance is not a body of content separately identified by academic disciplines, but a collection of concepts, drawn from many sources, that are useful to several professions. But even when the professional groups are more sharply separated in the advanced stages of the programme there may still be both core experiences and focused options as further specialization replaces basic professional competence as the principal educational goal.

Use of an integrated approach to medical education or endorsement of a core curriculum appears to have several advantages over subject-centred instruction: fusing distinct scientific and clinical disciplines makes learning more meaningful for students; courses may be streamlined by eliminating areas of redundancy while strengthening those of greatest importance; and, with careful advance planning, integrated curricula can bring the experience of medical education closer to the work of medical practitioners.

COMPETENCY-BASED CURRICULUM

Medical education that is competency-based differs from the subject-centred and the integrated course models in 3 fundamental ways. First, such a curriculum is organized around functions (or competencies) required for the practice of medicine in a specified setting. Secondly, it is grounded in the empirically validated principle that students of the intellectual quality found in medical schools, when given appropriate instruction, can all master the prescribed basic performance objectives. Thirdly, it views education as an experiment where both the processes of student learning and the techniques used to produce learning are regarded as hypotheses subject to testing. The intended output of a competency-based programme is a health professional who can practise medicine at a defined level of proficiency, in accord with local conditions, to meet local needs.

The critics of this model rarely get beyond the question: "What is competent medical practice?" It would be pointless to suggest that there is a single definition. Competence includes a broad range of knowledge, attitudes, and observable patterns behaviour which together account for the ability to deliver a specified professional service. The competent doctor can correctly perform numerous (but not necessarily all) clinical tasks, many of which require knowledge of the physical and biological sciences or comprehension of the social and cultural factors that influence patient care and well-being. Competence in this sense also involves adoption of a professional role that values human life, improvement of the public health, and leadership in settings of health care and health education. The competencies are many and multi-faceted. They may also be ambiguous and tied to local custom and constraints of time, finance, and human resources. Nevertheless, a competency-based curriculum in any setting assumes that the many roles and functions involved in the doctor's work can be defined and clearly expressed. It does not imply that the things defined are the only elements of competence, but rather that those which can be defined represent the critical point of departure in curriculum development. Careful delineation of these components of medical practice is the first and most critical step in designing a competency-based curriculum.

When students master the medical functions that comprise an acceptable repertoire of professional practices they are judged to be ready to work as physicians. But what does mastery learning require and how can a student's mastery of the necessary medical competencies be assured?

Technically, mastery learning means that, given adequate preparation, unambiguous learning goals, sufficient learning resources, and a flexible time schedule, students can with rare exceptions achieve the defined competence at high levels of proficiency. The technology of mastery learning requires: (1) knowledge of what a student brings to a learning task, not merely what is to be taken from it; (2) that broadly defined competencies of medicine be dismantled into smaller, cumulative steps, through which students may work at individual rates using many learning resources (books, laboratory experience, teachers, and other things) according to their own needs and rates of progress; and (3) that student achievement be thoroughly assessed at each learning stage in order to document the growth of competence and to provide valuable feedback on the quality of instruction.

The principles of learning for mastery—i.e., entry-level testing, stepwise instruction, flexible time scheduling, and frequent assessment—describe the operational characteristics of the competency-based curriculum model, which leads to cumulative learning along a continuum of increasing medical sophistication. A frequent bonus in

such a system is that the rate of learning accelerates as the student's experience grows, thus reducing the time needed to achieve programme goals. For example, when a combination of clinical problems, independent study, audiovisual materials and computer-based mastery testing was used, Sorlie and co-workers[1,2] reported that one group of medical students was able to satisfy basic science requirements, usually achieved after 2 years, in only 1 year.

The competency-based curriculum model also calls for new skills on the part of teaching staff. The remainder of this monograph is devoted to the steps they must take in constructing and implementing such a programme.

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[1] SORLIE, W. E. ET AL. A one year program in basic medical science. *Journal of medical education*, **48**: 371 (1973).

[2] SORLIE, W. E. & JONES, L. A. Description of a computer-assisted testing system in an independent study program. *Journal of medical education*, **50**: 81 (1975).

CHAPTER 2

IDENTIFYING THE ELEMENTS OF COMPETENCE

Defining professional competence is the cornerstone upon which a competency-based programme of medical education is built. Unless this task is approached both thoughtfully and systematically the medical curriculum is more likely to be a reflection of faculty interests than of student and public needs. It is to the mechanisms for developing such a definition that this chapter is addressed.

GENERAL CONSIDERATIONS IN DEFINING COMPETENCE

The desirable attributes of a health professional, whether physician or nurse or basic medical scientist, are determined by many influences. Expert opinion, the practice setting, the types of patients or the health care problems to be encountered, the nature of a discipline or a specialty, the stage of socioeconomic development of a community or nation (present as well as future) all deserve consideration. In reaching a decision about the competence goals for a specific curriculum, planners may examine all or select only a few of these essential determinants, depending upon the type of health professional being trained, the curiculum level, or simply the time and resources available. Whatever sources are employed the primary consideration in planning must always be the nature of the professional role a graduate must play, not merely the information that faculty experts are most comfortable in teaching.

For example, Adjou-Moumouni[1] provides a portrait of the medical competencies to which curricula in the developing nations of Africa should be directed, noting that the physician graduate should be able to:

1. Detect the major communicable diseases plaguing the community.
2. Treat individuals or groups affected by these diseases.

[1] ADJOU-MOUMOUNI, B. *On developing curriculum to train physicians according to the needs of African countries.* Chicago, IL, Center for Educational Development, University of Illinois College of Medicine, 1972 (unpublished manuscript).

3. Recommend or organize measures for preventing such diseases from spreading throughout the community.
4. Identify the social or economic significance of communicable or noncommunicable disease prototypes and suggest appropriate social measures.
5. Diagnose and treat organic and functional disorders affecting the major body systems.
6. Analyse the consequences of disease on the individual's life and family and take the necessary action to minimize the sequelae of the disease.
7. Analyse the influence of social, economic, and environmental factors on the health status of individuals and groups, and suggest appropriate measures for their correction.
8. Collaborate with governmental and private organizations to provide a healthful environment, good food, and better use of available resources to meet the needs of the community.
9. Obtain community participation in solving health problems.
10. Lead the health team, supervising their activities, supporting their morale, and helping to solve their problems.
11. Use record systems to supply information to upper levels.
12. Participate in national health planning.
13. Pursue his own professional education.

Except for items 1, 2, and 5 these elements of competence do not match what is typically emphasized in medical training: diagnosis and treatment of particular complaints in individual patients. They are not only more comprehensive but also deal with issues of administrative leadership, liaison with governmental bodies, social research, and consumer education which are commonly ignored or neglected in medical curricula.

Yet contrast the description of needs in developing Africa with those seen in an urban medical centre of industrialized North America where another observer comments:

> "During a three-month rotation at Boston's Beth Israel Hospital . . . I came across a computer program that evaluates a patient's metabolic status at least as well as the average physician could . . . a Harvard nephrologist interested in computer applications to medicine was able to devise a program, to act as a physician's consultant, that can accept the relevant metabolic data, demand more if necessary, and, in milli-seconds, provide the doctor with a list of diagnoses (in order of probability), explanation of the physiology involved, appropriate therapies, potential problems to watch out for, and even a list of recent references in case the doctor wants to learn more about the condition."[1]

In such an advanced setting the doctor's work may increasingly centre on managing man–machine interactions, with computers performing

[1] AVORN, J. The future of doctoring. *Atlantic*, **243** (Nov.): 71 (1974).

much of the diagnostic work and paramedical personnel applying therapies under the physician's supervision. Yet these aspects of competence may also be overlooked in the medical curriculum.

The sharp differences between these examples simply underscore what should be obvious: the definition of medical competence is bound to local political, social, and economic circumstances, to health needs, to the availability of resources and to the structure of the health care system. Thus any effort to find a universal definition of competence will inevitably fail. The "good physician" in one setting may be totally incompetent in another.

But basic medical scientists may wonder how such definitions can be helpful to them in making curriculum decisions. Here it is necessary not only to identify but also to separate competencies that are required in an expert in a particular discipline and those demanded of a student whose goal is the practice of medicine. Preparation of students for a career in teaching and research is a legitimate and desirable objective for a basic science department, but it should be a curriculum determinant only for those students with that career goal, not for all students. There may be common elements of competence for the two groups—for example, making independent observations, formulating and testing hypotheses, analysing data and drawing conclusions that are consistent with recorded findings—but there must be a considerable difference in the depth as well as the breadth of that competence between the two groups of students, a difference so great that a single course of instruction for both is probably inappropriate. The task of the basic scientist, working with clinical colleagues, is to determine the elements of a practitioner's professional competence to which basic science may contribute. The more common strategy of offering a basic science course in the hope, or even the expectation, that at some future time it may serve the physician-graduate is not satisfactory.

Acknowledging the many factors that influence the definition of competence, curriculum planners must collect data from multiple sources to ensure a wide sample. Many methods can be used but they vary in usefulness as well as practicality. Ideally a medical school staff will employ several techniques but even limited information gathered systematically is more useful than random impressions. As an operational principle it would be wise to begin with what is near at hand, using simple procedures, before moving to more complex techniques. The following suggestions are based on that premise.

ANALYSIS OF PHYSICIAN'S ACTIVITIES

Documentation of what physicians do can provide insight into how their time is spent, and into the critical elements of performance that

provide the most effective patient care (or alternatively those that may impede effective care). While incomplete as a curriculum determinant, precise information on these matters will facilitate the task of curriculum designers and make the product of their efforts more realistic, whether they work in the USA or the United Kingdom, in Argentina or Sri Lanka.

Data about the daily work schedule of a physician can be gathered in several ways: (1) a personal account of activities; (2) observation by peers or others; (3) task analysis. The selection of any one or more of these techniques will depend on the resources available and the readiness of individual practitioners to cooperate. Simply soliciting that cooperation, however, is often an important first step in establishing the better lines of communication between those who practise and those who teach which are essential to continuing curriculum improvement.

Self-reports

Self-reports are the most direct way to collect functional data, but may be the most difficult since they require busy practitioners to take on yet another task that cannot contribute directly to the care of their patients. None the less, this technique is worth considering not only for the information it provides to curriculum designers, but also as a means of involving physicians in the analysis of their own performance, a critical component of meaningful continuing self-education.

The methods that can be employed are of varying sophistication and reliability. The simplest is a daily narrative diary which allows each physician to carry out the task in an independent and unconstrained fashion. But this advantage in recording is a disadvantage in analysis since the lack of standardization in terminology and content makes summarization virtually impossible without an immense investment of time and effort. However, such narratives can provide enlightenment about problems, opportunities, frustrations, and achievements that might not otherwise be revealed to faculty members seeking information on what their graduates do, and thus for what they should be educated.

For analytical purposes it is much easier to ask a practitioner to complete some standard form after each encounter with a patient (or a specified sample of those encounters) over a fixed time period. Fig. 1 shows one such form that has been successfully used in the USA for this purpose; Fig. 2 shows another of somewhat greater complexity. Clearly generalizations about the nature of what practitioners do cannot be made from the information provided by any one individual but if, for example, it is shown that among 100 participating physicians 15% of patients were over 65 and that in 50% of all patient encounters

FIG. 1. EXAMPLE OF PATIENT ENCOUNTER FORM[a]

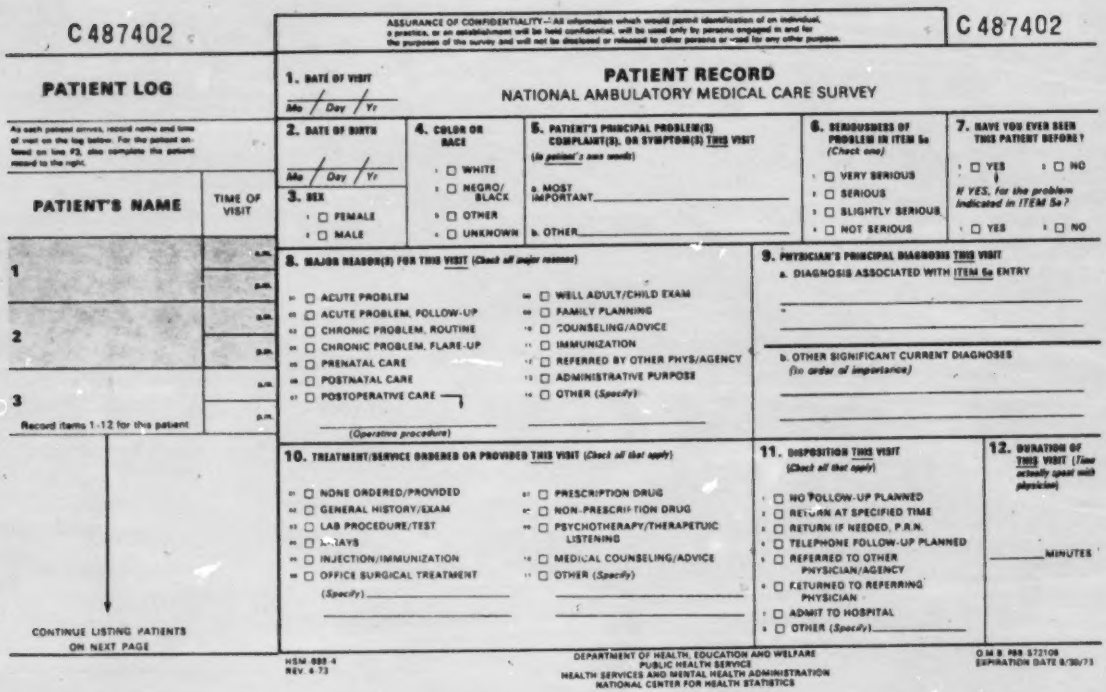
Please record the information for all patients seen midnight to midnight on two successive days of full time practice. If a diagnosis or probable diagnosis cannot be made, ignore the last column. If the visit is not made for an illness (for example, immunization) specify in Reason For Visit Column. Estimate age if not known.

DATES ON WHICH PATIENTS WERE SEEN: _____ month _____ day #1 _____ day #2 _____ year

	WHO?				WHERE?	HOW LONG?	WHY?		AVERAGE # OF VISITS BY A PATIENT WITH THIS DIAGNOSIS	
									ACUTE PATIENTS	CHRONIC PATIENTS
#	AGE	RACE	SEX	OCCUPATION	HOME, OFFICE, HOSPITAL, OR ELSEWHERE	RECORD LENGTH OF ACTUAL CONTACT WITH PATIENT IN MINUTES	SYMPTOMATIC REASON FOR VISIT	DIAGNOSIS (if established) OR PROBABLE DIAGNOSIS	Number of visits per illness	Number of visits per year

[a] STOREY, P. B. ET AL. *Continuing medical education: a new emphasis*, Chicago, IL, 1968 (reproduced by permission of the American Medical Association).

FIG. 2. SECOND EXAMPLE OF PATIENT ENCOUNTER FORM [a]



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ASSURANCE OF CONFIDENTIALITY — All information which would permit identification of an individual, a practice, or an establishment will be held confidential, will be used only by persons engaged in and for the purposes of the survey and will not be disclosed or released to other persons or used for any other purpose.

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PATIENT LOG

As each patient arrives, record name and time of visit on the log below. For the patient entered on line #3, also complete this patient record to the right.

PATIENT'S NAME	TIME OF VISIT
1	a.m. / p.m.
2	a.m. / p.m.
3	a.m. / p.m.

Record items 1-12 for this patient

CONTINUE LISTING PATIENTS ON NEXT PAGE

PATIENT RECORD
NATIONAL AMBULATORY MEDICAL CARE SURVEY

1. DATE OF VISIT — Mo / Day / Yr

2. DATE OF BIRTH — Mo / Day / Yr

3. SEX
- 1 ☐ FEMALE
- 2 ☐ MALE

4. COLOR OR RACE
- 1 ☐ WHITE
- 2 ☐ NEGRO/BLACK
- 3 ☐ OTHER
- 4 ☐ UNKNOWN

5. PATIENT'S PRINCIPAL PROBLEM(S) COMPLAINT(S), OR SYMPTOM(S) THIS VISIT (In patient's own words)
a. MOST IMPORTANT _____
b. OTHER _____

6. SERIOUSNESS OF PROBLEM IN ITEM 5a (Check one)
- 1 ☐ VERY SERIOUS
- 2 ☐ SERIOUS
- 3 ☐ SLIGHTLY SERIOUS
- 4 ☐ NOT SERIOUS

7. HAVE YOU EVER SEEN THIS PATIENT BEFORE?
- 1 ☐ YES
- 2 ☐ NO

If YES, for the problem indicated in ITEM 5a?
- 1 ☐ YES
- 2 ☐ NO

8. MAJOR REASON(S) FOR THIS VISIT (Check all major reasons)
- 01 ☐ ACUTE PROBLEM
- 02 ☐ ACUTE PROBLEM, FOLLOW-UP
- 03 ☐ CHRONIC PROBLEM, ROUTINE
- 04 ☐ CHRONIC PROBLEM, FLARE-UP
- 05 ☐ PRENATAL CARE
- 06 ☐ POSTNATAL CARE
- 07 ☐ POSTOPERATIVE CARE → _____ (Operative procedure)
- 08 ☐ WELL ADULT/CHILD EXAM
- 09 ☐ FAMILY PLANNING
- 10 ☐ COUNSELING/ADVICE
- 11 ☐ IMMUNIZATION
- 12 ☐ REFERRED BY OTHER PHYS/AGENCY
- 13 ☐ ADMINISTRATIVE PURPOSE
- 14 ☐ OTHER (Specify) _____

9. PHYSICIAN'S PRINCIPAL DIAGNOSIS THIS VISIT
a. DIAGNOSIS ASSOCIATED WITH ITEM 5a ENTRY
b. OTHER SIGNIFICANT CURRENT DIAGNOSES (In order of importance)

10. TREATMENT/SERVICE ORDERED OR PROVIDED THIS VISIT (Check all that apply)
- 01 ☐ NONE ORDERED/PROVIDED
- 02 ☐ GENERAL HISTORY/EXAM
- 03 ☐ LAB PROCEDURE/TEST
- 04 ☐ X-RAYS
- 05 ☐ INJECTION/IMMUNIZATION
- 06 ☐ OFFICE SURGICAL TREATMENT (Specify) _____
- 07 ☐ PRESCRIPTION DRUG
- 08 ☐ NON-PRESCRIPTION DRUG
- 09 ☐ PSYCHOTHERAPY/THERAPEUTIC LISTENING
- 10 ☐ MEDICAL COUNSELING/ADVICE
- 11 ☐ OTHER (Specify) _____

11. DISPOSITION THIS VISIT (Check all that apply)
- 1 ☐ NO FOLLOW-UP PLANNED
- 2 ☐ RETURN AT SPECIFIED TIME
- 3 ☐ RETURN IF NEEDED, P.R.N.
- 4 ☐ TELEPHONE FOLLOW-UP PLANNED
- 5 ☐ REFERRED TO OTHER PHYSICIAN/AGENCY
- 6 ☐ RETURNED TO REFERRING PHYSICIAN
- 7 ☐ ADMIT TO HOSPITAL
- 8 ☐ OTHER (Specify) _____

12. DURATION OF THIS VISIT (Time actually spent with physician)
_____ MINUTES

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REV. 4-73

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
NATIONAL CENTER FOR HEALTH STATISTICS

O.M.B. #68-S72108
EXPIRATION DATE 6/30/73

[a] UNITED STATES DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. *National ambulatory care* survey: 1973 survey, Washington, D.C., 1975.

only counselling (and not more specific therapy) was given, these findings should suggest to a teaching staff some of the competencies toward which the educational programme should be directed.

Observation

It is obviously easier for an individual physician to have the task of recording his activities carried out by someone else. It may also provide more reliable data since trained observers, using an observational guide and checklist, are less likely to disregard small but potentially important bits of information that doctors may consider trivial. Busy physicians are also subject to significant error in reporting what they do if the recording is not made at regular and frequent intervals. While the presence of an observer may have some influence upon a practitioner's behaviour, the gain in reliability of what is described is probably worth the small potential loss in validity. If the data are to achieve the desired degree of accuracy and completeness the observer must not only be trained in use of the observation instrument, but also have some familiarity with medicine. One way in which this has been accomplished in several studies is by employing medical

TABLE 2. EXAMPLE OF A SIMPLE OBSERVATIONAL GUIDE[a]

1. Intravenous therapy: time actually spent in administering intravenous therapy to any patient.
2. Patient and relative contact: history taking; physical examinations; procedures (lumbar punctures and so forth) — time spent only with patient; conferences of doctor and patient alone — doctor and his patient (not a patient of another intern) in the presence of other personnel, such as on rounds; and conferences with relatives of patients.
3. Communication with staff (about clinical subjects only): conferences with nurses, superiors, colleagues, students or administrators in the patient's absence: conferences with any of these personnel in the presence of a patient of another intern; and chart work and the writing of orders.
4. Ancillary services: walking; waiting; telephoning; form writing; messenger and delivery work; setting up intravenous or procedure apparatus (in the absence of the patient); and laboratory work.
5. Personal activities: eating; toilet; recreation; reading (medicine); and conversation.
6. Sleeping.
7. Miscellaneous.

[a] PAYSON, H. E. ET AL. Time study of an internship on a university medical service. *New England journal of medicine*, **264**: 439 (1961).

students as observers. This has the additional advantage of providing such students with a new set of insights about the professional role for which they are preparing, through intimate acquaintance with what physicians do hour by hour, not merely what they do in the dramatic moments of triumph over obscure illness.

In one such study of hospital practice the observer simply recorded time spent in each of 7 categories (Table 2). In another, a far more detailed checklist was employed (Fig. 3). Each provided significant data about the realities of medical practice, data that demand attention in curriculum planning. For example, observation of the work of paedia-

FIG. 3. EXAMPLE OF A MORE COMPLEX OBSERVATIONAL GUIDE[a]

PROFESSIONAL ACTIVITIES

CODE	ACTIVITY
	Total time with patients (Also fill out attached sheet)
P-P et	Examining (including laboratory work) and treating—no verbal exchange
P-P	Exchanging information with patients (e.g. taking history, explaining diet instruction, explaining disease process, counseling, etc.)
P-P eti	Examining, treating *AND* exchanging information
Note:	The remainder of the professional activities may or may not take place when doctor is with patients. If the doctor is with a patient, place a P before code. (*Example:* Physician writes notes in patient's chart when with patient: P-P-C, Physician writes note in chart when not with patient: P-C)
P-A	Checking appointment log
P-B	Banking and related activities
P-C	Writing notes on patient's chart
P-DM	Talk to detail men
P-DC	Completing death certificates
P-F	Filing
P-I	Completing and signing insurance forms
P-LR	Filling out lab report forms
P-LW	Doing laboratory work
P-M	Opening and reading mail
P-MD-t	Talking to physicians *on telephone* (1) to get information about patient referred to him, (2) to refer patient, (3) transfer trusteeship when not on call (e.g. going out of town). For #2 and #3, note if specific problems are discussed.
P-MD-p	*In person* (same as above)
P-O	Ordering supplies
P-S	Supervision—personnel management and instructions
P-Tel SS	Social service—arranging for community, health services for patients (welfare, MediCal, health department, Social Security, homemaker service, etc.) Note type of service.
P-Tel a	Talking to answering service
P-Tel h	Calling hospital to admit patient
P-Tel p	Talking on telephone to patients
P-Tel f	Talking on telephone to patient's family
P-Tel Rx	Calling in prescriptions to pharmacy
P-Tax	Completing tax forms
P-T c	Travel by car from office to and from hospitals, nursing homes, patient's homes.
P-T f	Travel by foot—Note destination
	Continuing Education
P-CE j	Reading medical journals
P-CE l	Attending lectures and seminars sponsored by hospitals, voluntary organizations, (Heart Assoc., Cancer Society), specialty groups. (Note sponsoring agency)
P-CE t	Listening to audio digest tapes
P-CE tv	Watching medical TV
P-CE c	Conversation on medical subjects with colleagues (not for referrals, social or organizational reasons.)
	Medical Community Service
P-MCS mm	Attending business meetings of medical organizations and committees (Note name of organization).
P-MCS mr	Attending meetings as representative of medical profession or medical organization (Note name of organization).
P-MCS t	Teaching seminars or other teaching activity (Note type).

ACTIVITIES NOT DIRECTLY RELATED TO PROFESSION

CODE	ACTIVITY
N-CB	Civic business (other than health)
N-Let	Dictating or writing personal letters
N-P	Eating, drinking, restroom
N-Po	Other personal business (Note type)
N-R	Reading newspaper, nonprofessional magazines, etc.
N-Tel p	Personal telephone calls
N-Tel cb	Telephone calls in connection with civic business
N-T ns	Talking with student observer
N-T c	Travel by car to and from nonprofessional activity (Note destination, e.g. City Hall)
N-T f	Travel by foot to and from nonprofessional activities
N-V	Passing time of day with friends, personnel or visitors (Note with whom)

LOCATION

H	Hospital
N	Nursing Home, Convalescent Home, etc.
PH	Patient's Home
O	Office

[a] BRODY, B. L. & STOKES, J. Use of professional time by internists and general practitioners in group and solo practice. *Annals of internal medicine*, **73**: 741-749 (1970) (reproduced by permission).

tricians in one study revealed that half their time was spent with well children and nearly a quarter with children suffering from simple respiratory disease.[1] While such findings cannot alone dictate the amount of curriculum time that should be given to instruction about healthy children or those with respiratory illness, it should bring into sharp focus some of the specific components of professional competence which must be perfected in order to deal successfully with 75% of the patient population. The same study also revealed that 15% of the practitioner's time was spent dealing with problems by telephone rather than in direct contact with patients, yet the skill of using a telephone effectively in managing paediatric disorders is not commonly taught even in countries where it is a major means of communication. And finally the study indicated that the average amount of time given to each patient was 11 minutes, scarcely the kind of encounter that is demonstrated in most formal programmes of medical education. In many countries the time would be even less, suggesting the importance of having students acquire, through planned education, the competence to identify major problems quickly, with a high degree of accuracy, and to decide promptly how best to deal with them.

Task analysis

The meticulous dissection and description of what a physician does may also be drawn from the combined opinions of experts, and not direct observation and analysis. While this has the disadvantage of being more an intellectual than an empirical exercise, it has the advantage of generating consensus, and is thus less subject to the criticisms often directed at generalizations about physician behaviour derived from observational or self-report methods. This technique has not often been applied to the delineation of physicians' practices but is widely used in outlining the functions and responsibilities of allied health professionals.

One sample of such a task analysis is shown in Table 3. It was developed by a group of respiratory therapists who defined the sequential steps in caring for a patient with a tracheostomy. This arrangement allows both teachers and students to see what must be learned first in order to gain the proficiency required to move to more difficult tasks. Many teachers would criticize such a tabulation as too specific and detailed for the advanced performance required of a physician. While they may be right, it would probably be unwise to dismiss the method without at least a trial, for many of the pitfalls in delivering health care appear to result from failure to exhibit the kind

[1] BERGMAN, A. B. ET AL. Time and motion study of practicing pediatricians. *Pediatrics*, **38**: 254 (1966).

TABLE 3. RESPIRATORY THERAPY COMPETENCIES NEEDED TO PERFORM TRACHEOSTOMY CARE[a]

Step 1: Procure equipment needed for tracheostomy care (not included)

Step 2: Perform tracheostomy care

A. Wash hands thoroughly with antiseptic solution.
B. Fill basins or cups with sterile water or saline and hydrogen peroxide, if needed.
C. Check for proper functioning of suction equipment.
D. Aseptically place sterile drape over patient's chest under tracheostomy.
E. Open sterile equipment.
F. Increase oxygen concentration being given to the patient, and, if possible, instruct him to take deep breaths.
G. Don sterile gloves and remove catheter from sterile packet.
H. Protect the sterile catheter in palm of hand which is to remain sterile and pick up suction connecting tube with hand to be contaminated and attach to suction catheter.
I. Using the contaminated hand, apply gentle pressure on the flange of the tracheostomy tube to prevent its being disloged (tubes with inner cannula), carefully unlock and remove inner cannula and place it in the bowl provided for its cleaning (bowl with hydrogen peroxide).
J. Suction the tracheostomy tube.
K. Reapply oxygen or ventilator before cleaning inner cannula.
L. With sterile forceps in contaminated hand, pick up enough pipe cleaners to clean lumen of inner cannula.
M. With hand which has been kept sterile for suctioning, remove inner cannula from bowl of hydrogen peroxide.
N. Advance pipe cleaner through lumen of inner cannula. Small wire and gauze strips may be substituted for pipe cleaners to clean inner cannula.
O. Rinse inner cannula thoroughly in bowl of sterile water or saline.
P. Replace inner cannula in tracheostomy tube carefully and lock in place.
Q. Change tracheostomy dressing when it gets soiled, but at least every 4 hours.
R. Replace humidified oxygen or ventilator (at pre-procedure concentration) and make the patient comfortable.

[a] METROPOLITAN GROUP OF HOSPITALS AND AREA HEALTH EDUCATION SYSTEM, ILLINOIS REGION 2, UNIVERSITY OF ILLINOIS AT THE MEDICAL CENTER. *A curriculum for respiratory therapy.* Chicago, IL, Aldine, 1975.

of competence described in such a task description. One of the limitations of task analysis as a mechanism for defining competence is that it does not reveal things that are being omitted, only what is being done.

CRITICAL ELEMENTS OF BEHAVIOUR

Delineation of competency would be incomplete if it dealt only with a quantitative description of practitioners' work. The description must also embrace the qualitative dimensions of care in order to define the elements of competence to which a curriculum should be addressed. The several techniques described here have all been used successfully in gathering such information.

Critical incidents

One of the most sophisticated methods for collecting behavioural data about the ingredients of professional competence is the critical incident technique.[1] Here qualified individuals are asked to describe incidents of medical care which they have observed and judged to reflect superior or poor performance. The judgement requested is of the incident, not of the individual, since even outstanding professionals occasionally falter and even tyros sometimes perform superbly. Each description includes the setting in which the event took place, exactly what occurred, an account of the outcome, and why it was judged to be effective or ineffective. As the number of individually described incidents grows larger they begin to fall into natural clusters and a detailed description of competence begins to emerge. Ideally the collection of incidents continues until the addition of 100 new events fails to add more than one new category of behaviour. One of the early applications of this technique to medicine was conducted for the National Board of Medical Examiners in the USA to describe the competence expected of a physician at the conclusion of an internship.[2] In a more recent study, carried out by the American Board of Orthopedic Surgery, 1761 separate incidents, contributed by nearly 1000 orthopaedic surgeons, were classified into 9 major categories and 94 subcategories of behaviour (Table 4).[3]

In these studies physicians were the source of descriptions about physician behaviour, but other sources may supply additional insights into other elements of proficiency that also deserve consideration. For example, in an effort to define competencies required in the practice of child psychiatry, specialists in the field were only one of the groups asked to provide critical incidents.[4] Paediatricians, who are the principal source of patient referrals, and judges in juvenile courts, where child psychiatrists often serve as counsellors or expert witnesses in cases involving delinquent children, were additional sources of information. Nonprofessional consumers of health services may also be useful providers of descriptive data. In a study on competency in family practice, Deisher[5] asked a randomly selected group of patients for incidents of

[1] FLANAGAN, J. C. The critical incident technique. *Psychological bulletin*, **51**: 237 (1954).

[2] AMERICAN INSTITUTE FOR RESEARCH. Classification of critical incidents: intern-resident performance. Pittsburgh, PA, 1960 (multilith).

[3] BLUM, J. M. & FITZPATRICK, R. *Critical performance requirements for orthopedic surgery*. Chicago, IL, University of Illinois College of Medicine, 1965 (multilith).

[4] BERNER, E. Toward a definition of competency in child psychiatry. In: *Report to the Faculty, 1975*. Chicago, IL, Center for Educational Development, University of Illinois College of Medicine (multilith).

[5] DEISHER, J. E. Defining the family physician: the patient's view. In: *Report to the Faculty, 1966*. Chicago, IL, Center for Educational Development, University of Illinois College of Medicine (multilith).

TABLE 4. EXAMPLES OF CRITICAL PERFORMANCE REQUIREMENTS FOR ORTHOPAEDIC SURGEONS [a]

I. Skill in gathering clinical information
- A. Eliciting historical information
  1. Obtaining adequate information from the patient
  2. Consulting other physicians
  3. Checking other sources
- B. Obtaining information by physical examination
  1. Performing thorough general examination
  2. Performing relevant orthopaedic checks

II. Effectiveness in using special diagnostic methods
- A. Obtaining and interpreting X-rays
  1. Directing or ordering appropriate films
  2. Obtaining unusual, additional or repeated films
  3. Rendering complete and accurate interpretation
- B. Obtaining additional information by other means
  1. Obtaining biopsy specimen
  2. Obtaining other laboratory data

III. Competence in developing a diagnosis
- A. Approaching diagnosis objectively
  1. Double-checking stated or referral diagnosis
  2. Persisting to establish definitive diagnosis
  3. Avoiding prejudicial analysis
- B. Recognizing condition
  1. Recognizing primary disorder
  2. Recognizing underlying or associated problem

IV. Judgement in deciding on appropriate care
- A. Adapting treatment to the individual case
  1. Initiating suitable treatment for condition
  2. Treating with regard to special needs
  3. Treating with regard to age and general health
  4. Attending to contraindications
  5. Applying adequate regimen for multiple disorders
  6. Inventing, adopting, applying new techniques
- B. Determining extent and immediacy of therapy needs
  1. Choosing wisely between simple and radical approach
  2. Delaying therapy until diagnosis better established
  3. Testing milder treatment first
  4. Undertaking immediate treatment
- C. Obtaining consultation on proposed treatment
  1. Asking for opinions
  2. Incorporating suggestions

V. Judgement and skill in implementing treatment
- A. Planning the operation
  1. Reviewing literature, X-rays, other material
  2. Planning approach and procedures
- B. Making necessary preparations for operating
  1. Preparing and checking patient
  2. Readying staff, operating room, supplies

[a] From BLUM & FITZPATRICK, op. cit.

C. Performing the operation
   1. Asking for confirmation of involved area
   2. Knowing and observing anatomical principles
   3. Using correct surgical procedures
   4. Demonstrating dexterity or skill
   5. Taking proper precautions
   6. Attending to details
   7. Persisting for maximum result

D. Modifying operative plans according to situation
   1. Deviating from preplanned procedures
   2. Improvising with implements and materials
   3. Terminating operation when danger in continuing

E. Handling operative complications
   1. Recognizing complications
   2. Treating complications promptly and effectively

F. Instituting a non-operative therapy programme
   1. Using appropriate methods and devices
   2. Applying methods and devices correctly

VI. Effectiveness in treating emergency patients

A. Handling patient
   1. Properly applying splints and other protective measures
   2. Handling and transporting carefully

B. Performing emergency treatment
   1. Determining location and extent of injuries
   2. Attending immediately to lifesaving procedures
   3. Treating most critical needs first
   4. Obtaining and organizing help

VII. Competence in providing continuing care

A. Paying attention postoperatively
   1. Administering suitable postoperative care
   2. Recognizing postoperative complications
   3. Adequately treating postoperative complications

B. Monitoring patient's progress
   1. Checking on effectiveness of therapy
   2. Reassessing, altering or repeating treatment

C. Providing long-term care
   1. Arranging for rehabilitative care, socioeconomic assistance
   2. Explaining and monitoring home and rehabilitative care

VIII. Effectiveness of physician-patient relationship

A. Showing concern and consideration
   1. Taking personal interest
   2. Acting in discreet, tactful, dignified manner
   3. Avoiding needless alarm, discomfort, or embarrassment
   4. Speaking honestly to patient and family
   5. Persuading patient to undertake needed care, or only needed care

Table 6. Continued

B. Relieving anxiety of patient and family
   1. Reassuring, supporting or calming
   2. Explaining condition, treatment, prognosis or complication

IX. Accepting responsibilities of a physician

A. Accepting responsibility for welfare of patient
   1. Heeding the call for help
   2. Devoting necessary time and effort
   3. Meeting commitments
   4. Insisting on primacy of patient welfare
   5. Delegating responsibilities wisely
   6. Adequately supervising residents and other staff

B. Recognizing professional capabilities and limitations
   1. Doing only what experience permits
   2. Asking for help, advice or consultation
   3. Following instructions and advice
   4. Showing conviction and decisiveness
   5. Accepting responsibility for own errors
   6. Referring cases to other orthopaedists and facilities

C. Relating effectively to other medical persons
   1. Supporting the actions of other physicians
   2. Maintaining open and honest communication
   3. Helping other physicians
   4. Relating in discreet, tactful manner
   5. Respecting other physician's responsibility to his patient

D. Displaying general medical competence
   1. Detecting, diagnosing, (treating) nonorthopaedic disorders
   2. Obtaining appropriate referrals
   3. Preventing infection in hospital patients
   4. Effectively keeping and following records

E. Manifesting teaching, intellectual and scholarly attitudes
   1. Lecturing effectively
   2. Guiding and supporting less experienced orthopaedists
   3. Encouraging and contributing to fruitful discussion
   4. Contributing to medical knowledge
   5. Developing own medical knowledge and skills

F. Accepting general responsibilities to profession and community
   1. Serving the profession
   2. Serving the community
   3. Maintaining personal and intellectual integrity

effective and ineffective professional performance they had experienced at the hands of family doctors. While these judgements cannot be regarded as definitive if they deal with medical facts, they are often much more useful than information gathered from either generalists or specialists in the realm of professional attitudes and values.

A full critical incident study is a formidable undertaking, but a less elaborate version of the technique can provide illuminating information about specific behaviour worthy of consideration by any faculty in the specification of curriculum objectives. In this limited fashion the technique is as practicable in a rural clinic in central Africa as it might be in a specialized hospital in central France.

Expert judgement

The judgement of experts has traditionally been the principal mechanism for identifying the professional behaviour towards which educational programmes are aimed. These descriptions may emerge from authoritative statements by acknowledged medical leaders on "what I expect my students to learn", from carefully or casually designed opinion polls, or from systematic surveys of the professional literature. Yet whatever the method, the final determination of what a competent doctor must know, the skills to be acquired, and the desired dimensions of professional attitudes and values come chiefly from the teaching staff. These conclusions vary in usefulness depending on the quality of the search and the nature of the sampling. The examples that follow illustrate some of the more successful techniques for eliciting expert judgement upon which decisions about curriculum content may be soundly based.

One of the issues that must first be addressed is identification of the experts from whom judgements are sought. They may be a highly select group, as in one effort to gain consensus about the components of competence in paediatric cardiology.[1] Here, 50 specialists were brought together in groups of 10 and asked to draw upon their personal experience in completing 5 judgemental tasks: (1) to define the general areas of knowledge and skill necessary for the practice of paediatric cardiology; (2) to rank general areas of knowledge and skill according to their relative importance; (3) to identify specific components within these general areas; (4) to provide an operational definition of these components; and (5) to designate the required level of competence which a certified paediatric cardiologist should demonstrate in each area. Out of this work emerged a generally acceptable list of items which embraced the principal elements of competence in that narrow field.

In attempting to achieve a similar consensus in ophthalmology, Spivey[2] used a different population of experts, since his goal was not to achieve agreement on the competence a specialist in the field should exhibit, but on what level of proficiency should be demonstrated by a

[1] ADAMS, F. H. The review and revision of certification procedures in pediatric cardiology. *Journal of medical education*, **47**: 769 (1972).

[2] SPIVEY, B. E. A technique to determine curriculum content. *Journal of medical education*, **46**: 269 (1971).

FIG. 4. EXPECTED COMPETENCE QUESTIONNAIRE[a]

When confronted by a cooperative patient with an ocular injury (e.g. corneal foreign body, acid body or injury, corneal or lid lacerations), a graduating medical student, as a minimum acceptable performance, should be able to:	Essential	Desirable But Not Essential	Useful But Should Not Be Required	Of No Importance	I Have No Basis for Judgement
1. Demonstrate immediate diagnostic measures	4	3	2	1	0
2. Initiate treatment of a non-penetrating injury.	4	3	2	1	0
3. Outline possible complications of therapy undertaken or considered.	4	3	2	1	0
4. Arrive at a decision within five minutes, of his own competence to continue in the same course of treatment, begin another, or refer the patient.	4	3	2	1	0
5. Demonstrate his ability to converse with the patient's family regarding:					
a. The possible need for further treatment.	4	3	2	1	0
b. The prognosis.	4	3	2	1	0
c. The time and cost involved in treatment and convalescence.	4	3	2	1	0

[a] SPIVEY (1971), op. cit. (reproduced by permission).

medical student at the time of graduation. His population sample included 66 directors of ophthalmology programmes, 204 medical teachers from many disciplines, 535 practising specialists (including but not restricted to ophthalmologists), 176 interns and residents, and 199 medical students. The study employed a structured questionnaire instead of individual generation and group discussion of views derived from personal experience. Each respondent was asked to judge the importance of specifically listed knowledge and skills for a graduating medical student faced by 7 key problems selected through earlier discussion and literature review. A sample of the questionnaire is shown in Fig. 4. The resulting consolidated list of generally agreed performance expectations is shown in Fig. 5.

In seeking a more precise definition of the competence in patient care which should be expected of any physician, Price et al.[1] took as their experts not only members of the health professions (physicians in practice, nurses, medical technicians, interns and residents), but also a

[1] PRICE, P. B. ET AL. Attributes of a good practicing physician. *Journal of medical education*, **46**: 229 (1971).

FIG. 5. POSSIBLE CURRICULUM CONTENT IN OPHTHALMOLOGY FOR MEDICAL STUDENTS[a]

As a minimum acceptable performance, a graduating medical student should be able to:

1. When given a cooperative patient with an opacity of the cornea or lens (i.e., cataract) or a retinal abnormality, utilizing external and funduscopic examination, elicit a history pertinent to the general health and ocular status and indicate verbally the location of the findings and describe the appearance.

2. When given a typically cooperative patient (ranging from a child of three years to a normal or illiterate adult, with "normal" or abnormal vision), obtain a history of the visual complaint; and measure and record the distance and near visual acuity.

3. When given any individual (newborn to elderly) with unilaterally or bilaterally red eyes, obtain a contributory history if possible; examine the patient and his eyes in a manner adequate to provide a decision about diagnostic possibilities and therapy; include in the decision a statement regarding etiology (i.e., injury, inflammation, glaucoma, infection, or degeneration); and take a culture if indicated by the examination.

4. When confronted by any cooperative adult patient, measure the patient's intraocular pressure with a Schiotz tonometer; and evaluate the nervehead (making a decision of normal, glaucomatous, or nonglaucoma but abnormal disc).

5. If given a cooperative child or an adult with strabismus, obtain a history of the general and ocular status; examine the patient in order to diagnose the type of strabismus (i.e., esotropia, exotropia, hypertropia); and obtain an estimate of the amount of deviation (small, moderate, large).

6. When confronted by a cooperative patient with an ocular injury (e.g., corneal foreign body, acid body or injury, corneal or lid lacerations), demonstrate immediate diagnostic measures; initiate treatment of a nonpenetrating injury; outline possible complications of therapy undertaken or considered; arrive at a decision within five minutes of his own competence to continue in the same course of treatment, begin another, or refer the patient; and demonstrate his ability to converse with the patient's family regarding the possible need for further treatment.

7. When given a cooperative patient with a neurological or neuro-ophthalmological problem, demonstrate his ability to distinguish abnormality from apparent normality in a neuro-ophthalmological examination by including examination of the retina and nervehead, plus ocular motility and pupillary reactions.

[a] SPIVEY (1971), op. cit. (reproduced by permission).

group of health service consumers (college students, members of minority groups, special ethnic groups). Like the ophthalmology study, this investigation also used a questionnaire. Each participant was asked to judge the relative importance of 116 performance qualities identified in an earlier inquiry which had tapped the views of a large number of health care providers and consumers. Samples of behaviours that emerged as most highly valued and those that were regarded most negatively are set forth in Fig. 6. The investigators found interesting differences among the respondent groups, but were impressed by the overall similarity in judgements. The most significant finding for purposes of educational programme review is the frequency with which things valued in physicians by "expert" providers or consumers, things which might be learned, are omitted from most medical curricula. In planning instructional programmes teachers need to consider the inclusion of these components of competence as well as the more conventional academic subjects.

FIG. 6. RANKING OF IMPORTANCE OF DIFFERENT PERFORMANCE QUALITIES IN A PHYSICIAN[a]

A RANKING OF 87 POSITIVE PHYSICIAN QUALITIES BASED ON THE RATINGS OF 1,604 RESPONDENTS

(Qualities are ranked from most important to least important)

1. Has good clinical judgment (the ability to reach appropriate decisions regarding the care of patients)
2. Has thorough up-to-date knowledge of his own field of medicine
3. Has knowledge and ability to study patients thoroughly, and reach sound conclusions regarding diagnosis, treatment, and related problems
4. Readily refers patients when it is to their advantage to do so
5. Habitually makes as thorough an examination of each patient as may be required for accurate diagnosis and proper treatment
6. Is wise, thoughtful; is able to get at the heart of a problem; is able to separate important points from details
7. Is strict about honoring confidences; avoids and discourages gossip
8. Is adaptable; is able to adjust to new knowledge and changing conditions
9. Provides treatment appropriate to the condition of each of his patients, with (in general) satisfactory immediate and long-range results
10. Is able to convert acquired information into working knowledge
11. Inspires confidence in his patients
12. Has intellectual honesty (incompatible with bluffing, cheating, assuming poses for ulterior purposes, trickery, claiming undue credit, assuming knowledge not really possessed, transferring blame unfairly, etc.) and forthrightness
13. Keeps completely honest records
14. Is alert, observant
15. Is able to be his own teacher; to learn from books and journals, from meetings and informal discussions, from experience and his own mistakes, etc., thus adding continually to his own education
16. Keeps full and accurate clinical records
17. Is emotionally stable
18. Has sustained genuine concern for patients during their illness and convalescence
19. Has awareness of emotional and psychosomatic factors in dealing with patients and their diseases
20. Is decisive; is able without undue delay to reach conclusions and act upon them
21. Is a stable, calming influence in critical or stormy situations
22. Is conscientious; strives for perfection in his work
23. Is equipped with an orderly mind; mentally efficient; logical
24. Is willing to take needed time to listen to patients' problems sympathetically and helpfully
25. Establishes good doctor-patient relationships

.....

etc.

A RANKING OF 29 NEGATIVE PHYSICIAN QUALITIES BASED ON THE RATINGS OF 1,604 RESPONDENTS

(Qualities are ranked from most undesirable to least undesirable)

1. Is negligent in handling of patients; uses slipshod methods (e.g., frequently makes diagnosis and prescribes antibiotics customarily without definitive diagnosis or sensitivity tests; examines patients in a cursory incomplete manner; excessive number of "exploratory" operations without careful preoperative diagnosis; etc.)
2. Is summoned frequently before monitoring committees for such things as malpractice, unnecessary surgery, excessive infection, morbidity or mortality rates, exorbitant fees, negligence of patients, etc.
3. Is devious, dishonest, deceptive
4. Is a chronic alcoholic
5. Is a narcotic addict
6. Is prone to jump to conclusions; to generalize from meager information; to make snap diagnoses
7. Exhibits unprofessional, unethical conduct (any behavior that would bring the medical profession into disrepute)
8. Is immodest in handling of female patients
9. Has not kept abreast of advances in medical knowledge
10. Holds on to patients to undue degree; disinclined to suggest or seek consultation; apt to be offended if patients request consultations or a transfer to another doctor
11. Is rude, discourteous; inconsiderate of others
12. Is unavailable except during specified business hours, even for emergencies
13. Is critical of other physicians behind their backs (whether for personal or professional reasons)
14. Is lazy
15. Is not interested in, and does not want to be bothered with, patients' subjective difficulties and problems
16. Is indecisive, unsure of self, basically an insecure person
17. Is inefficient, disorganized

.....

etc.

[a] PRICE, P. B. ET AL. op. cit. (reproduced by permission).

HEALTH CARE NEEDS

In the end it is the health care needs of the community, and the resources available to meet those needs, that should provide the principal directional signals in building a curriculum. No matter what the interests of teachers, the hopes of patients, or the aspirations of a society, medical education should first address the realities that exist, or can reasonably be expected to develop during the professional lifetime of a graduate. It is wrong to train physicians to a high level of competence in dealing with problems they will rarely encounter while neglecting the acquisition of deep concern for and skill in managing problems that will be met with great frequency. Yet it seems to happen regularly in all parts of the world. It is equally wrong to educate physicians in such a way that they are satisfied only with a level of care that cannot be supported by the society in which they must work. But this also appears to occur with disheartening frequency. In determining competency goals for a programme of medical education the teaching staff must first examine carefully and thoughtfully the conditions that graduates must face, and arrange an educational programme which prepares them for that role.

Public health statistics

Public health statistics represent one major clue to the knowledge and skills medical graduates must acquire. In virtually all developed nations, as well as in a steadily growing number of those still developing, mortality and morbidity data are available and periodically updated. Even in countries that have not yet established a systematic process of monitoring public health, the experience of health personnel may be drawn upon to establish crude estimates of the major problems they encounter. To whatever extent this information can be assembled, it should influence the delineation of curriculum content and the professional competence toward which instruction is aimed. If, for example, malnutrition and diarrhoeal disease produce the highest morbidity and mortality, then proficiency in managing these problems must be of the highest priority even at the expense of other topics that may be a greater intellectual challenge to the teaching faculty.

In the absence of detailed morbidity and mortality statistics, even such simple information as age distribution of the population can serve as a guide to curriculum content. Since some 41% of the population of the less developed countries is aged under 15 years and only 4% is over 65, whereas the corresponding proportions in the more developed countries are 27% under 15 and 10% over 65 (1970 figures),[1] it would be reasonable to expect that education of medical students in developing

[1] UNITED NATIONS. *World population prospects as assessed in 1973*, New York, 1977 (Population Studies No. 60).

nations would be heavily weighted toward the health problems of infancy and childhood, while that in the industrialized countries would be dominated by the problems of aging. Yet neither emphasis is found with any regularity. There are, of course, those who would say that education directed toward the practical matter of dealing with what is currently prominent overlooks the importance of preparing students for solving health problems not yet clearly understood, in a future that can be perceived only dimly. It is true that such a risk exists, but it can be minimized by methods of instruction (described in chapter 3) designed to prepare students for continuing their own independent learning rather than to anticipate during the period of university medical education all their educational needs for a professional lifetime.

Medical records

Medical records from hospitals, health centres, or individual physician practices represent another potential source of information about needs that can guide curriculum developers. Regrettably, careful and systematic record-keeping is not uniformly carried out. Even when kept, records may be in a form that is virtually useless for analysis aimed at documenting the nature of health problems seen. While deploring this situation, many thoughtful practitioners take the position that proper record-keeping is so time-consuming that it cannot be carried out in the face of more urgent demands in patient care. This view may be accurate. It may also represent rationalization of a disinclination to keep detailed records, or simple rejection of the record-keeping methods learned in medical school, which may have seemed an academic formality rather than vital documentation of health care. This is not the place to debate that issue, but it may be the place to urge the adoption of simple record-keeping methods that do not require a large investment of time or effort, and that could provide important data for educational programme planning, not to mention the contribution those records would make to health care.

And it can be done. In a rural hospital in Nigeria, a modest punch card system was employed to record such standard items as individual patient identification, diagnosis, length of hospital confinement (if any), and therapeutic procedures for obstetrical cases. Simple statistical analysis of these data was carried out easily and provided such helpful information as:

"In the six years 1957-1962 there were 6,848 confinements. Of these, 422 were twin confinements, an incidence of 1 : 16. Of the 6,426 singleton confinements, 307 were delivered by Caesarean section (4% of primigravidae, 5.1% of multigravidae). One hundred and seventy-one patients were delivered by forceps (2.7%), 9 patients underwent symphisiotomy, and in 28 patients a destructive operation was required. It is rare to

find heart disease, thrombophlebitis, embolism or varicose veins in pregnancy, and we have never had a case of diabetes".[1]

A comparable record-keeping system at 29 rural health centres in Thailand provided the information shown in Table 5.

TABLE 5. MOST FREQUENT DIAGNOSES AT 29 RURAL HEALTH CENTRES IN THAILAND DURING 1969[a]

Diagnosis	% of cases
Common cold and influenza	13.60
Gastroenteritis and colitis (diarrhoea and dysenteries)	10.11
Common skin diseases (dermatophytosis, scabies, pediculosis)	9.76
Malaria	6.26
Inflammation of eyes (conjunctivitis and trachoma)	5.80
Accidents, poisoning and violence	2.14
Beri-beri	2.11
Tuberculosis	0.19
Nutritional disorders	0.85
Complication of pregnancy and labour	0.28
Simple goitre	0.28

[a] SUWANWELA, C. Pattern of diseases in Thailand. *Chulalongkorn medical journal*, **15**: 1 (1970) (reproduced by permission).

Unless curriculum planners have access to such data they may be forced to depend on information gathered from experience in urban settings where most medical teachers work. This will almost certainly provide an unreliable picture of national health care needs. For example, in one country where the cause of death is regularly recorded only in the capital city of each state, no deaths from smallpox were reported in 1970; but 1771 cases, many fatal, were identified by surveillance methods in the country at large.[2]

Medical records *can* be kept even in busy, ill-equipped rural settings if those in responsible positions recognize that there is a more important reason for doing so than merely fulfilling a bureaucratic demand. One of those reasons is to provide more realistic information on which to build a description of the professional competencies that physicians must acquire in the course of a medical education.

Social, economic, and political realities

Medical education and medical practice exist as a part of the social system, not apart from it. Medical teachers may wish this were not so, and often organize educational programmes for which they are responsible as though it were not so. They may even be proud that

[1] CANNON, D. S. H. & HARTFIELD, V. J. Obstetrics in a developing country. *Journal of obstetrics and gynaecology of the British Commonwealth*, **71**: 940 (1964).

[2] KOCH-WIESER, D. ET AL. *An introduction to international health. I. World-wide overview of health and disease*. Washington, DC, Association of American Medical Colleges, 1975 (multilith draft).

graduates satisfy some external criterion of quality (e.g., a high grade in the Educational Council for Foreign Medical Graduates examination in the USA). But such an effort to meet an ill-defined international standard of excellence will usually be at the expense of meeting a clearly evident national standard of health service need. Educational quality should be judged by the success with which it meets needs, not by the success with which its graduates practise in another setting. The social and economic realities of any nation *must* be reflected in the programme through which its physicians are educated.

The competence which a physician must acquire to be successful in a nation with only one doctor for every 29 000 people (and one nurse for 43 000), and which can afford only about US $1 *per capita* for health services, is obviously very different from that required where there is one physician for every 960 persons (and one nurse for each 200), and the *per capita* health services investment is US $88.00.[1] This stark fact should not deter the former country from striving to achieve what the latter already has, but such dramatic changes are rarely swift, and in the meantime physicians must live and work with what is, not with what might be. A medical school which feels this responsibility will manifest that feeling by rejecting competency goals that are inappropriate for the setting, rather than fostering them in the hope that things may change.

Medical educators do not function alone in making these decisions. They may be encouraged by political policies to strive for a level of medical education, and an array of competencies in their graduates, that serve national pride rather than national need. Or they may be encouraged by political decisions to abandon pride, and adopt a system of health personnel education and health services delivery addressed to the desperate needs that lie all about them, even though it may not match poorly defined but none the less pervasive concepts of international standards.

It might be noted, for example, that in one country, the People's Republic of China, the leaders, in an attempt to improve the quality of health care, looked first at what resources were then available.[2] They found mostly herb doctors, many of whom were barely literate, but at least they were there and the people both trusted and accepted them. These indigenous health workers were given a rudimentary education in medicine for 3 months, were taught how to take a blood pressure, count a pulse, read a thermometer, and recognize obvious symptoms of disease. As time passed they were taught to use a few basic drugs, but

[1] See, for instance: BRYANT, J. *Health and the developing world.* Ithaca, NY, Cornell University Press, 1969, p. 56.

[2] WEN, C. P. & HAYS, C. W. Medical education in China in the post Cultural Revolution era. *New England journal of medicine*, **292**: 998 (1975).

most importantly to recognize their own limitations and when faced by problems beyond their own competence to pass the patient on to the next level of the health service system.

Such an approach does not mean that the standard of competence for every medical practitioner in China has been reduced to this level; it means only that the health personnel education system has adapted to social and economic needs as reflected in political decisions about national priorities. Neither does it suggest that any nation should adopt what has been found useful elsewhere. It merely emphasizes that each medical school, wherever located, needs to take the realities of national life into consideration when identifying the competencies to which the educational programme is to be directed.

The illustrations need not be multiplied, for the point must by now be very evident: there is no single set of competencies that characterizes all physicians. Any medical school that aims at such a target is pursuing an illusion. The hard work medical teachers must undertake, before beginning what is ordinarily thought of as teaching, is to define the specific competencies their students must acquire to meet the real needs of the constituency they are being prepared to serve.

PROFESSIONAL PERFORMANCE SITUATION MODEL

The argument has now been fully developed that professional performance does not occur within a vacuum; it takes place within the context of a reality defined by variables such as those explored in this chapter. Recognizing this inescapable fact, a special study group at the University of Illinois Center for Educational Development has created a new conceptual model for defining competency objectives[1,2]. This concluding section is largely derived from its work, which has dealt with 2 allied health professions: occupational therapy and dietetics.

In summary, proficient professional performance in this model is defined by a three-dimensional universe (Fig. 7) in which each dimension identifies one essential feature: the client, the problem, the setting. Three-way intersections within the cube represent discrete situations which a competent practitioner must be prepared to manage in an appropriate fashion. Each of the 3 variables has been further elaborated in order to account for the fullest range of possibilities from which a profession may then identify educational priorities in terms of situations, not of content alone.

[1] LaDuca, A. et al. *Professional performance situation model for health professions education: occupational therapy*. Chicago, Center for Educational Development, University of Illinois College of Medicine, 1975 (multilith).

[2] LaDuca, A. et al. *Toward a definition of competence in dietetics*. Chicago, Center for Educational Development, University of Illinois College of Medicine, 1975 (multilith).

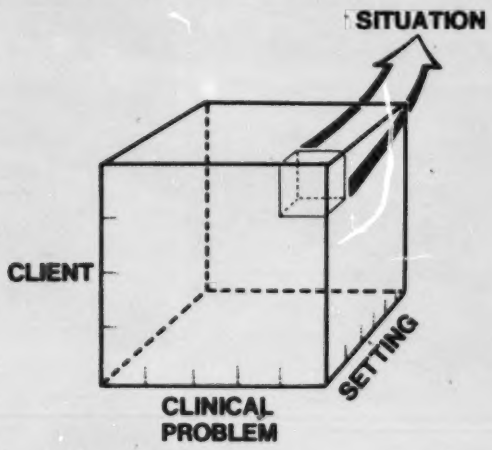
For example, in occupational therapy in the USA these components of a professional competence situation universe have emerged:

1. *Patient/client*
   - A. Age and sex
   - B. Ethnic group/religion
   - C. Socioeconomic class
   - D. Occupation
   - E. Marital status
   - F. Education
   - G. Other significant persons in life setting
2. *Clinical problems*
   - A. Developmental
   - B. Physical
   - C. Psychosocial
3. *Setting*
   - A. Acute hospital
   - B. Nursing home
   - C. Rehabilitation centre
   - D. Outpatient clinic
   - E. Psychiatric unit
   - F. Community agency

   Etc.

Approximately 200 clinical problems with which occupational therapists deal have been identified in 4 major patient age categories

FIG. 7. PROFESSIONAL COMPETENCE SITUATION UNIVERSE[a]



[a] LADUCA, A. ET AL. *Professional performance situation model for health professions education : occupational therapy*. Chicago, Center for Educational Development, University of Illinois College of Medicine, 1975 (multilith).

by a special task force of occupational therapists in the USA (a selection of these problems is given in Table 6 as an illustration); specific dysfunctions were also specified and associated with these clinical problems (Table 7). While the full inventories described in this manner are important in defining the universe of professional competence, they are generally too cumbersome to be operationally useful. Therefore, it is necessary to select from the universe those situations that have the highest priority, in order to preclude instruction or testing on rarely encountered problem situations, and to avoid unnecessary duplication (for example, in terms of the tasks an occupational therapist must perform, to determine whether cerebral palsy in a child is significantly different from the same disorder in an adult). The resulting "critical mass" of situations identifies the array of problems with which an occupational therapist must be prepared to deal.

A final requirement is elucidation of the professional performance elements that must be employed in all situations. For occupational therapy, 5 consistent performance roles were specified: (1) evaluation; (2) programme planning; (3) programme implementation; (4) re-evaluation; and (5) discontinuation. Each of these roles has been further elaborated (Fig. 3) to guide both teachers and students toward the

TABLE 6. SELECTED CLINICAL PROBLEMS ACCORDING TO PATIENT AGE AND DISABILITY [a]

Age category	Principal disability: Psychosocial		Principal disability: Physical	
Child (< 12)	Autism School phobia Pica	Leukaemia Sickle cell anaemia	Burns Spina bifida Blindness Muscular dystrophy	
Adolescent (13-17)	Schizophrenia Drug dependence	Infectious hepatitis Diabetes	Spinal cord injury Haemophilia Cerebral palsy	
Adult (18-64)	Alcoholism Psychosis Sexual deviance	Ulcer Nephritis/nephrosis Diabetes	Multiple sclerosis Cerebrovascular accident Neoplasms	
Aged (≥ 65)	Senile dementia Neurosis	Diabetes	Arthritis Parkinson's disease Arteriosclerosis Emphysema Cerebrovascular accident	

[a] LADUCA, A. ET AL. *Professional performance situation model for health professions education: occupational therapy.* op. cit.

TABLE 7. OCCURRENCE OF SPECIFIC DYSFUNCTIONS IN SELECTED CLINICAL PROBLEMS ENCOUNTERED BY OCCUPATIONAL THERAPISTS[a]

Specific dysfunction	Illustrative clinical problem							
	Schizophrenia	Alcoholism	Senile dementia	Leukaemia	Burns	Spinal cord injury	Multiple sclerosis	Arthritis
Psychosocial								
Apathy				X				
Depression	X	X	X	X	X	X		X
Ego problems	X	X	X		X	X	X	
Hallucinations		X	X					
Inappropriate use of defence mechanisms	X		X	X			X	
Situational fears	X		X	X				
Withdrawal	X	X	X	X	X		X	X
Physical								
Athetosis								
Contractures				X	X	X	X	X
Incoordination							X	
Joint limitation				X	X	X	X	X
Muscle weakness						X	X	X
Pain					X			
Prosthesis								
Sensory loss	X				X	X	X	
Spasticity						X		

[a] Adapted from: LADUCA, A. ET AL. *Professional performance situation model for health professions education: occupational therapy.* op. cit.

competency goals of education in this profession. A sampling derived from a master grid of patient situations is set forth in Fig. 9.

A comparable delineation of professional competence has also been accomplished in dietetics,[1] where 5 client categories have been specified (infant, child, adolescent, adult, aged); 5 dietary interventions in over 200 clinical problems identified (physical composition of food, meal frequency, overall food intake, specific nutrient intake, and no dietary modification); 14 settings established (university hospital, community hospital, clinic, home, etc.); and 4 roles elaborated (assessment, planning, implementation, evaluation).

No comparable work has yet been done in medicine. Growing interest in determining more precisely the services best provided by auxiliaries, generalists and specialists, in primary health centres, district clinics, regional hospitals and university medical centres, suggests that

[1] LADUCA, A. ET AL. *Toward a definition of competence in dietetics.* op. cit.

FIG. 8. OCCUPATIONAL THERAPY (OT) CLIENT MANAGEMENT PERFORMANCE MODEL[a]

ROLE	FUNCTIONS	PROBLEMS
I. EVALUATION OF ASSETS & DEFICITS	A. Preliminary assessment	- What are the client's probable problem areas?
	B. Selection of appropriate instruments and/or techniques	- What evaluative information is needed? - How should it be obtained? - What factors influence administration?
	C. Administration of selected instruments	- What is client's performance in relevant components?
	D. Interpretation of collected data	- What is level of client's performance in relevant components? - What are deficits in performance levels?
	E. Utilization of other information sources, e.g. chart, other consultation	- What additional information is needed? - How should it be obtained?
	F. Communicating (recording and reporting)	- What should be recorded, reported, for what purpose? - In what form? - To whom?
II. PROGRAM PLANNING	A. Specification of program (treatment) goals	- What are relationships among client's component performance levels? - What are client's needs? - What needs can be met by O.T.? - What are client's priorities? - What are long-range goals? - What other treatments are being administered?
	B. Identification of treatment methods and sequence	- What interventions are needed, i.e. restoration, adaptation, prevention of deterioration, maintenance of functioning? - What activities comprising interventions accomplish restoration, et. al.? - What is optimal sequence of goals and activities? - How is treatment in concert with rest of treatment program?
	C. Identification of personal and institutional facilitation and constraints	- What characteristics of client influence program implementation? - What external factors influence program implementation? (treatment, institutional, social)
	D. Modification of selected treatment methods	- How are selected treatment methods individualized?
	E. Recording and reporting	- What should be recorded, reported? - In what form? - To whom?

[a] LADUCA, A. ET AL. *Professional performance situation model for health professions education: occupational therapy,* op. cit.

Fig. 8. Continued

ROLE	FUNCTIONS	PROBLEMS
III. IMPLEMENTATION	A. Preparation of treatment materials and/or environment	- What materials and/or environment are needed?
	B. Motivation of client and/or others	- What techniques are needed to develop and/or maintain cooperation of family, etc.?
	C. Instruction of client and/or others	- What are proper processes, techniques for particular treatment modality? - What modifications are needed for particular client? - What "others" need to be instructed? How accomplish?
	D. Manipulation of therapeutic relationship	- What kind of interaction should be developed in order to accomplish goals (both client-therapist and client-other relationships)?
	E. Supervision of client activities	- What type of supervision is needed?
	F. Adjustment of treatment approach in light of emergent factors	- What changes are needed in light of information gained during interaction with client? - What performance should be reevaluated and when?
	G. Recording and reporting	- What should be recorded, reported? - In what form? - To whom?
IV. RE-EVALUATION	A. Identification of changes in client performance and/or circumstances	- What is client's performance at this point in treatment? (improvement, same, deterioration) - What other circumstances have changed to influence client's status? - How do changes in performance and circumstances relate to goals?
	B. Revision of program plan	- How have needs of client changed? - What goals need to be changed? - How should program be revised in light of changes identified (activities, schedule)? - How should locus of treatment be changed (outpatient, home)?
	C. Recording and reporting	- What should be recorded, reported? - In what form? - To whom?
V. DISCONTINUATION	A. Specification of discharge or follow-up plan	- What is present status of patient in regard to previously stated needs and goals? - What cannot be accomplished under present program? - Who can meet any remaining needs?
	B. Recording and reporting	- What should be recorded, reported? - In what form? - To whom?

FIG. 9. SAMPLE FROM MASTER GRID[a]

PATIENT SITUATION No.	AGE CATEGORY	CLINICAL PROBLEM	CLINICAL SETTING	SEX/AGE	SIGNIFICANT OTHERS	SOCIO-ECONOMIC STATUS	HOUSING	SPECIFIC DYSFUNCTION
5	Child	Burn	Acute hospital, burns unit	M/6 yr	2 Parents, 4 siblings, 1 grand parent	Lower-class	Inner-city apartment	Reduction of selected function; trauma; isolation; pain; susceptibility to infection; possible body image distortion; possible joint limitation; lowered sensory input; probability of contracture.
6	Child	Cerebral palsy	Community agency	F/10 yr	1 Parent, 2 siblings	Lower-middle class	Suburban row house	Retardation; athetoid movements; facial grimacing, associated movements; poor eye-hand coordination; residual asymmetrical tonic neck reflex; muscle tone and range of motion normal; socially and emotionally immature; nervous, fear of failure; poor peer relationships.
8	Adolescent	Rheumatoid arthritis	Outpatient, occupational therapy clinic	F/13 yr	1 Parent, 4 siblings, 1 aunt	Lower-middle class	Urban garden apartment (6 steps down)	Limited range of motion in shoulders, elbows, wrists, hands and lower extremity joints; diminished muscle strength; pain in shoulders, elbows, wrists, knees and ankles; anaemia, poor appetite; mood swings, depressed, uncommunicative; negative attitude; easily discouraged.
13	Adolescent	Drug dependence	State psychi. hospital	M/15 yr	1 Step-parent, 3 siblings	Lower-class	Correctnl institution	Suicide attempts, without remorse; depression; hopelessness; poor impulse control; anger; overriding guilt; delinquency; glue sniffing.
9	Adult	Radical mastectomy	Acute hospital	F/40 yr	Married, 2 siblings	Middle-class	Suburban house	Muscle strength: fair in shoulder to 45°; others normal; range of motion: limited in shoulder (active and passive), some limitation, (active and passive) of elbow due to swelling of arm; pain at surgery and donor site; reduced endurance; fearful of moving arm; self-conscious; anxious about appearance, progress, relationship to husband.
7	Aging	Chronic brain syndrome	Nursing home	F/72 yr	Widow, 2 children (married)	Lower-class	Urban house	Impairment of memory, orientation, and intellect; irresponsibility; situational fear; denial of condition/hostility toward children and nursing home staff; diabetes, associated blurring vision.
15	Aging	Malnutrition	Home	M/70 yr	Widower, no child	Lower-class	Urban apartment (3rd-floor walk-up)	TB ; secondary malnutrition; severe weight loss; low endurance; periods of disorientation.

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[a] Adapted from : LADUCA ET AL. op. cit.

the time to attempt this task has come. Unless the situational variable is systematically incorporated in the specification of competencies towards which educational programmes are directed, medical school teachers will probably be inclined to continue in the future, as they have been in the past, to see the world of medicine, and thus of medical education, from the limited perspective of their own work setting.

CHAPTER 3

LEARNING FOR MASTERY

If achieving professional competence represents the goal of an educational programme, and a curriculum provides the mechanism through which such competence is to be acquired, it is important to ask what principles are used to determine the nature and organization of student learning experiences. Three themes stand out in current debates about instructional strategies: time; sequence; and mastery learning.

PROGRAMME ORGANIZATION: TIME

Learning to become a physician is bound to take time, but the question of how much time has never been answered with any high degree of confidence. In most of Europe the modal duration of a university course in medicine is 6 years, although the period may be one year longer or shorter depending on the country in which the course is taken. In the USA a comparable programme (in college and medical school) usually occupies 8 years, although a few special programmes may be completed in 6 years or less. Within the autonomous schools of a single country the range of time given to instruction in individual disciplines may be equally wide. For example, a 1961 study of United States and Canadian medical schools[1] revealed that "the scheduled hours of instruction in biochemistry extend from a low of 144 to a high of 338; pathology ranges from 108 hours in one school to 462 hours in another; one institution reports 1135 scheduled hours in surgery, while another reports 195; psychiatry claims 560 hours in one and 40 in another". And 13 years later the information derived from a random sample of 30 American medical schools[2] still revealed an instructional range in anatomy from 105 hours to 395 and in physiology from 27 to

[1] MILLER, G. E. An inquiry into medical teaching. *Journal of medical education*, **37**: 185 (1962).

[2] ASSOCIATION OF AMERICAN MEDICAL COLLEGES. *1973-1974 AAMC curriculum directory*. Washington, DC, 1973.

240, with an equal spread in most other subjects. The time required for postgraduate training of a generalist or specialist shows an even wider range, since the objectives for that phase of education and the legal requirements for registration are neither consistent nor universal.

Since educational programmes are planned by educators, although often under the influence of legislators, it can only be concluded that those responsible for these programmes must believe that the time required by a department, an institution or a nation is proper, but there is very little evidence to support those individual conclusions. In fact, the most widespread cry among medical educators everywhere appears to be that they have insufficient time to teach their subject, whatever the amount of time available to them.

To bring some sense of perspective into the chaotic arguments about time and learning, Shulman[1] has written:

> "Consider the analogy of a race. Imagine the mile run if it began with the firing of a gun and ended at the end of four minutes when another gun went off and everyone had to stop wherever they were. It would be even more ludicrous if about five minutes later another gun went off for the next race and everyone began the next race at the point from which they had ended the previous one. We would find it rather laughable, and yet we run our educational programmes in precisely this manner. Ostensibly, our purposes in education, especially in medical education, are to see to it that a certain minimal level of competence is established for each learner. Therefore, we should logically set levels of achievement as constants and let time act as a variable. Instead, we do exactly the opposite. We set time as a constant and have students run until their time is up. The grades we give reflect how far they have gotten in the race within the time span we have allotted."

Since there is no discernible evidence that time is the significant variable when learning for mastery of defined professional competence represents the educational goal, curriculum committees around the world should be able to end the regular battles about time allocation that seem to dominate their deliberations. The time saved might then be devoted to fruitful discussion of other variables. One of these is sequence.

PROGRAMME ORGANIZATION: SEQUENCE

The presentation of subjects in a particular order implies that completion of those given early in the curriculum is required for success in later subjects. Successful advancement through a programme is equated with accumulating professional competence, and such competence is in turn assumed to reflect an appropriate ordering of the learning experiences.

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[1] SHULMAN, L. S. Cognitive learning and the educational process. *Journal of medical education*, **45** (Nov. suppl.): 90 (1970).

Despite the wide range of difference in time and specific content of courses of instruction, there is a general similarity of sequence in all parts of the world. The curriculum usually begins with the basic sciences (such as mathematics and chemistry, physics and biology), moves to the preclinical sciences (such as anatomy, physiology, microbiology and pharmocology), and ends with the clinical disciplines (always including medicine, surgery and paediatrics, with variable incorporation of other general and specialized subjects). Within each of these segments, however, there is the widest possible variation in sequence: gross anatomy may precede or be offered simultaneously with histology; it may precede or follow physiology and biochemistry; microbiology is sometimes given early and at other times late in the preclinical course. The sequence in the initial basic phase and the ultimate clinical science portions of the programme is even more varied from country to country and institution to institution.

Such observations, in the absence of other data, can only lead to the conclusion that a particular sequence is more the product of local custom than a manifestation of some generally accepted educational principle. Certainly a search of the health professions literature provides no data from which an investigator of curriculum organization might conclude that there is any optimal sequence. At best that literature seems to offer impassioned arguments indicating how individuals or groups *believe* the sequence of courses should be arranged, and there is little agreement among them.

Nor is there much evidence to support the view that what comes first in existing curricula is required to succeed in what comes later. The rapid decay of unused knowledge has already been noted and merely needs reemphasis here through reference to another study in which retained learning of "prerequisite" physics and chemistry was tested at the beginning of a medical course in physiology.[1] Not only was it found that few students recalled enough to achieve again a passing grade in those subjects 6–16 months after completing the original course, but also that "good" students performed only marginally better than "poor" students. Although this was not specifically stated, the reader was left with the inference that whatever the level of performance in those subjects it had little influence upon later peformance in physiology.

If the present sequence is more often a reflection of educational custom than of learning principle, and there is limited evidence to suggest that what is customarily offered early will significantly influence achievement in what comes later, then a teaching staff might reasonably

[1] BLIZARD, P. J. ET AL. Medical students' retention of knowledge of physics and chemistry on entry to a course in physiology. *British journal of medical education*, **9**: 249 (1975).

ask what difference it makes how the curriculum is organized. And if there were no better way, the discussion (and this volume) might end here. However, data on learning, as well as the experience of teachers (not to mention that of learners), suggest that there may be a more efficacious organization. In a paper contributed to the Third World Conference on Medical Education (New Delhi, 1966), Ramalingaswami[1] wrote:

> "In this regard it is illuminating to peruse a page from a diary of the rural health center attached to the All-India Institute of Medical Sciences. On the morning of October 13, 1966, the intern, under supervision, had to tackle the following problems in the health center.
>
> "1. An eighteen-year-old person with chronic ulcer of the foot of seven years' duration complicated by a discharging sinus. In this case the intern debated the possibility of chronic osteomyelitis or a fungal infection and ordered an X-ray.
> "2. A boy with a toothache.
> "3. A two-year-old child with diarrhea and vomiting.
> "4. An elderly woman with a low back pain.
> "5. A three-year-old child with fever, toxic signs, marasmus, and loose motions, who had been treated earlier unsuccessfully by a Hakim, a practitioner of an indigenous system of medicine. The intern felt that he needed laboratory aids in this case to arrive at a diagnosis.
> "6. A thirty-five-year-old man with clinical features of pulmonary tuberculosis.
> "7. Two children with mild upper respiratory tract infection.
> "8. A child with recurring boils on the forearms.
> "9. A full-term expectant mother, markedly anemic. The intern was faced with the problem of raising the woman's hemoglobin rapidly before she went to term.
> "10. A child with florid kwashiorkor. The mother was expecting another child.
> "11. Late in the evening of the same day, an individual who had been bitten by a snake, along with hordes of relatives and friends, and the dead snake! Rather than losing himself in the drama of the situation, the intern's first move was to look at the snake to decide whether or not it was poisonous.
>
> "Here is a tangled mixture of trivialities and serious ailments, of acute emergencies and chronic indolent illnesses of community medicine. In such a setting, the young intern must *act*. He must make decisions with inadequate data, with too many variables. He cannot refer all or most of the patients to the big hospital, for he would soon be left with none! He must make tentative clinical diagnoses based on intelligent guesswork. Therefore, the focus of the educational process should be on problem-solving, decision-making, and judgement."

This suggestion that education in medicine be built around the processes of problem-solving, decision-making, and judgement would be supported by learning theorists, who have long recognized that knowledge must be put to use if it is to acquire meaning and to be remembered. It is this organizing principle that has led to such problem-based curricula as that developed at the University of Illinois College

[1] RAMALINGASWAMI, V. Factors influencing the development of the medical curriculum. *Journal of medical education*, **43**: 212 (1968).

of Medicine's School of Basic Medical Sciences at Urbana/Champaign, where basic sciences are learned in the context of a defined set of clinical problems rather than through organized disciplinary instruction. The initial results of this programme[1] indicate not only that students gain a real appreciation for the role of basic sciences in medical care, but also that the learning process is accelerated. An even more extensive illustration of this orientation is found in the curriculum of the McMaster Faculty of Medicine in Canada,[2] where the entire curriculum is organized around problems whose solution requires the integration of basic and clinical sciences, and which lead to a steadily expanding repertoire of clinical competencies. For here the goal is not to complete a series of discrete disciplinary courses but to master the elements of professional competence derived from many disciplines.

The key word, then, is mastery.

PROGRAMME ORGANIZATION: MASTERY

Mastery means nothing more or less than achieving the degree of competence identified as the educational objective. It makes no reference to the time that will be given to, or required for, such achievement; neither does it determine the sequence in which this learning will be accomplished. Mastery learning demands only that the goal be reached. Philosophically and operationally it is very different from the traditional approach to education. As one author[3] has described it:

> "Mastery learning... offers a powerful new approach to student learning which can provide almost all students with the successful and rewarding learning experiences now allowed to only a few. It proposes that all or almost all students can master what they are taught. Further it suggests procedures whereby each student's instruction and learning can be so managed *within the context of ordinary group-based classroom instruction*, as to promote his fullest development. Mastery learning enables 75 to 90% of the students to achieve the same high level as the top 25% learning under typical group based instructional methods. It also make student learning more efficient than conventional approaches. Students learn more material in less time. Finally mastery learning produces markedly greater student interest in and attitude toward the subject learned than usual classroom methods."

Implementation of such a system demands substantial redefinition of faculty and student roles and responsibilities. In the usual organization of education instructors are in full control, prescribing how students shall

[1] SORLIE, W. E. ET AL. A one year program in basic medical science. *Journal of medical education*, 48: 371 (1973).

[2] NEUFELD, V. & BARROWS, H. *The McMaster philosophy—as seen in 1973*. Hamilton, Ontario, McMaster University Faculty of Medicine, 1973 (multilith).

[3] In: BLOCK, J. H., ed. *Mastery learning: theory and practice*. New York, NY, Holt, Rinehart & Winston, 1971.

learn (usually by listening to teachers); in what setting they will learn (usually a classroom, laboratory, ward or clinic); and for what period of time they will be taught (a course of hours, days, weeks). At the end, they judge the extent to which faculty expectations have been met, their assessment usually being communicated by letter grade—A, B, C, D or E; a number—90,83,65; or words—high honours, honours, pass, fail. In a mastery system teachers must relinquish a substantial measure of that control. They generate objectives, but by using the sources outlined in Chapter 2 rather than independently. They then help students to discover the meaning of those objectives and the array of learning resources that may be used independently, at a pace and in a sequence most productive for each individual. And with students (rather than for them), teachers attempt at regular intervals to assess progress toward the objectives, so that in the end the only judgement rendered is "mastery achieved" or "not yet achieved." Teachers and students are linked in a partnership in which their behaviour is governed by a shared effort to fulfil unambiguous competency expectations, not those derived from a calendar, a clock, or the special interests of individual instructors or departments. These new roles will be dealt with at length in Chapter 5. Here the logical steps in designing, implementing, and operating a mastery programme of education for the health professions will be outlined.

Specification of learning objectives

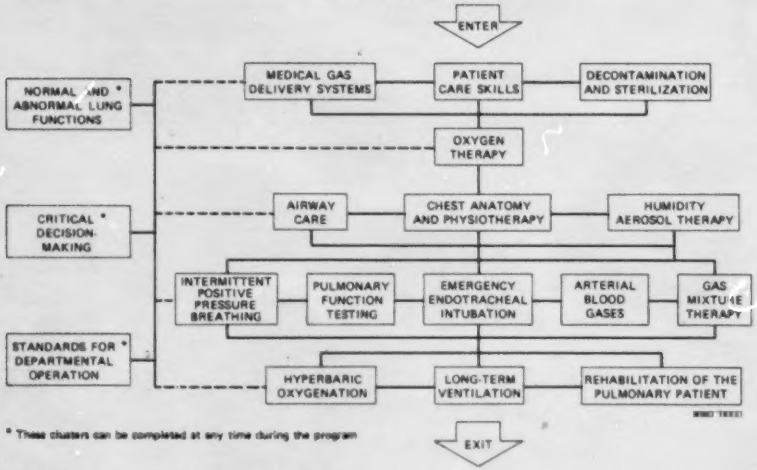
When competence is the goal of an educational programme, the first step in programme design must be a clear and precise listing of the components of that competence. This may be done for an entire programme, if the staff has sufficient time, energy and commitment, or for segments alone, if that is the only realistic way in which a start can be made. But if the latter option is chosen it should be recognized as only a first step toward the more comprehensive effort. The sources of objectives and the mechanisms for establishing priorities have already been dealt with in the preceding chapter, and need only be underscored here.

Identification of curriculum clusters

No small part of the task of creating a competency-based curriculum with a mastery goal lies in the identification of related pieces which may be drawn from several discrete biomedical disciplines but which fall naturally together in some logical pattern. For example,

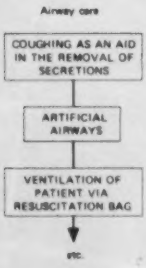
in a recently developed curriculum for respiratory therapy (which, while designed for training technicians, can also serve other professional groups), the total programme emerged as 18 major clusters of competency, each of which had multiple subunits.[1] While a sequential path through the programme was suggested, a considerable degree of flexibility was also built in, as the chart in Fig. 10 suggests.

FIG. 10. STUDENT PROGRESS THROUGH THE RESPIRATORY THERAPY CURRICULUM



Development of instructional units

Each unit within each cluster is essentially self-contained. It includes an explicit listing of objectives to be achieved, suggestions about instructional sources that might be employed (such as excerpts from textbooks, journal articles, laboratory or clinical experiences, simulation exercises, audio and video materials designed specifically to serve the objective), and self-tests which allow each student individually and privately to determine whether the learning objectives are being achieved.


Airway care
COUGHING AS AN AID IN THE REMOVAL OF SECRETIONS
ARTIFICIAL AIRWAYS
VENTILATION OF PATIENT VIA RESUSCITATION BAG
etc.

An example of the detail that might be incorporated in the outline for each unit is set forth in Fig. 11 on "Coughing as an aid in the removal of secretions", which is taken from the cluster on airway care illustrated here.

[1] Metropolitan Group of Hospitals and Areas Health Education System, Illinois Region 2, University of Illinois at the Medical Center. *A curriculum for respiratory therapy*, Chicago, IL, Aldine, 1975.

The question that will occur immediately to any reader is whether every instructional unit must be so detailed, for if this is required the task of creating a competency-based, mastery-oriented curriculum for medical education is formidable. The answer must be that the greater the specificity the higher the probability of success, but with the unusually intelligent and independent students who are admitted to medical schools such detail is probably less important than in programmes aimed at a less select student population. The most important element is the effort invested by the teaching staff in making explicit what they want students to learn, and communicating those expectations through a written document that serves as a constant reference for both teachers and learners.

Encouragement of self-pacing

Many teachers accept the theory of mastery learning yet resist its requirement that students should be allowed to pace themselves through the programme. They may acknowledge the importance of defining objectives, organizing a programme into discrete units, encouraging an orderly sequence of learning experiences, establishing mastery standards, and creating an evaluation mechanism to ensure that virtually all students achieve those goals. Any major disagreement is not conceptual, but at the practical level of anticipating potential chaos when limited numbers of staff must oversee the work of a large student body in which each individual may be at a different place in the course of study. This is a legitimate point that cannot be evaded, but it can be answered realistically only when teachers accept a role different from that they now play, a role of instructional manager rather than information source. If they are unwilling to adopt the principle that students may learn without being "taught" (in the conventional sense), or if they are unable to provide the resources required to allow such independent and self-paced learning, it would be unwise to attempt this major break with a traditional curriculum structure. Such a decision should only be made, however, after recognizing that the evidence strongly supports the view that a competency-based, mastery-oriented programme can in the long term be more efficient, more effective, and more economical.[1,2]

Recognition of competence levels

A significant problem in any programme of professional education, and one that is exaggerated in a programme with mastery as an explicit

[1] Block, J. H., ed., 1971, op. cit.

[2] Block, J. H. Mastery learning in the classroom : an overview of recent research. In : Block, J. H., ed. *Schools, society and mastery learning.* New York, NY, Holt, Rinehart & Winston, 1974.

goal, is the definition of what mastery means. Many medical teachers have unrealistic expectations. Their instruction aims at an advanced level of mastery rather than something simpler—as though students would never again have an opportunity to learn what they want to teach. The continuum of medical education does provide opportunity for elementary, intermediate and advanced levels of learning. A competency-based curriculum can exploit that opportunity by explicit definition of steadily more complete and sophisticated performance as students move through the educational programme. For example, the following levels of competence in examination of the cardiovascular system might be identified as end-points for several segments of the basic curriculum and postgraduate training period:

A. *At the end of an introductory course in physical diagnosis a student will be able to*

- recognize the presence of gross abnormality in pulse rate or rhythm
- recognize the presence of grade III cardiac murmurs
- if the pulse rate is below 90, and cardiac rhythm is regular, determine whether a murmur is in systole or diastole
- detect through palpation of the apex impulse or percussion of the cardiac outline any gross enlargement of the heart (i.e., more than 3 cm beyond normal limits)
- etc.

B. *At the time of graduation from medical school a student will be able to*

- identify with 60% accuracy the following abnormalities of pulse rate or rhythm: tachycardia, bradycardia, auricular fibrillation, premature ventricular contractions
- detect, through palpation or percussion of cardiac outline, moderate enlargement or significant displacement of the heart
- recognize the presence and describe the timing and character of grade II cardiac murmurs and list the major anatomical lesions that might produce such abnormal sounds
- identify abnormality in cardiac configuration on posteroanterior and lateral chest X-ray films, and list major forms of cardiac pathology that might produce such changes
- identify the presence of abnormality in rhythm and in cardiac axis from standard limb lead electrocardiograph
- etc.

C. *Upon completion of internship a physician will be able to*

- identify with 80% accuracy the above-noted abnormalities of pulse rate and rhythm; describe character of pulse and recognize implications of pulsus parvus et tardus, shallow pulse of shock, bounding pulse of thyrotoxicosis, etc.
- detect, through palpation or percussion of cardiac outline, minimal enlargement or displacement of the heart
- recognize the presence and describe the timing and character of Grade I cardiac murmurs

— identify abnormalities in cardiac configuration revealed by posteroanterior, lateral and oblique chest X-ray films and through fluoroscopy; list major forms or cardiac pathology that might produce such changes

— identify nature of abnormality of cardiac rhythm, and presence of acute myocardial damage on standard 4-lead electrocardiogram.

— etc.

Frequent assessment of learning

If either interim levels of learning or mastery of the ultimate competence objectives of a curriculum are to be achieved, frequent assessment is an essential component of programme organization.

Examinations are most commonly used to determine educational achievement in medical schools, or professional status following graduation. Regrettably, such examinations are often seen by both teachers and students as a mechanism for eliminating those who cannot show a high level of academic achievement, although this measurement may have little demonstrable relationship with qualification for delivering health care. In a competency-oriented curriculum which is based upon objectives derived in the manner described in Chapter 2, and which uses the procedures outlined here to assure mastery of required learning, it is expected that virtually all students will succeed. Examinations are used chiefly as tools along an individual learning path to identify the deficiencies that can be corrected by further study, and only at the end to certify that the competence objectives have in fact been mastered. Thus interim as well as terminal examinations that address the components of competence, rather than the informational elements of learning alone, must occupy a central position in the curriculum.

FIG. 11. EXAMPLE OF INSTRUCTIONAL UNIT ON "COUGHING AS AN AID IN THE REMOVAL OF SECRETIONS"

GOAL

To enable the student to teach and assist patients in the technique of secretion removal by cough.

COGNITIVE OBJECTIVES

I. State in a paragraph or less, the definition of a cough, and the reason for its importance. (Cherniack, et. al., 168)

II. Briefly explain in a paragraph the mechanism of nervous stimulation leading to a cough. (Cherniack, et. al., 168-169)

A. Irritation of nerve endings

B. Impulses transmitted to a "cough center" in the medulla

C. "Cough center" sends impulses to muscles of chest and larynx

III. Describe the location of various nerve endings participating in cough stimulation. (Cherniack, et. al., 168)

A. Sensory endings of vagus nerve in larynx, trachea, and bronchi

B. Nerve endings located in mucous membrane of pharynx, esophagus, pleural surfaces, and external auditory canal

IV. List four ways in which a cough may normally be stimulated. (Cherniack, et., al., 169)

A. Inflammatory stimulation

B. Chemical stimulation

C. Thermal stimulation

D. Mechanical stimulation

V. List and explain the four phases of a cough. (Cherniack, et. al., 169)

A. Irritation

B. Deep inspiration

C. Compression

D. Expulsion

VI. Describe briefly, the role of the diaphragm in a cough. (Cherniack, et. al., 170)

A. During initial deep inspiration

B. During expulsion

Fig. 11. Continued

VII. Write five common faults of voluntary coughing. (Hammond's Review Outline, 80)

A. Apical instead of diaphragmatic filling -- usually due to too rapid inspiration

B. Forced, high pitched throaty noise (slows flowrate)

C. Holding breath and making a noise followed by expiration

D. Putting the tongue out in the expiratory phase

E. Compressing lips during expiration

VIII. List three ways in which coughs may be produced manually. (Petty, 108-109; Sykes, 87-91)

A. Using Ambu bag, chest physical therapy, and manual thoraco-abdominal compression

B. Tracheal tickling (Depression above the supramanubrial notch)

C. Pharyngeal suction

D. Respiratory stimulants (to be performed only by a physician)

E. Cricothyroid cannulation (to be performed only by a physician)

IX. Describe the manner in which an incorrectly performed cough may produce an episode of acute air trapping in a patient with chronic obstructive lung disease. (Bryan and Taylor, 116)

A. Increase in intrathoracic pressure during cough

B. Collapse of weak bronchioles

X. Describe in writing the reason assistance with coughing is needed in the following type of patients. (Bryan and Taylor, 115-116)

A. Post-operative or post-traumatic pulmonary restriction patients

B. Patients exhibiting post-ventilator weakness

C. Patients with chronic obstructive lung disease

XI. State briefly the difference in coughing techniques that should be used for the types of patients mentioned in objective X. (Bryan and Taylor, 115-116)

IMPORTANT WORDS AND CONCEPTS

Abdominal viscera
Acute air trapping
Compression
Diaphragm
Expulsion
Glossopharyngeal nerve
Glottis
Inspiratory capacity
Intrathoracic pressure
Lateral costal margins
Supramanubrial notch
Transtracheal injections
Vagus nerve

REQUIRED STUDY AND RESOURCES

Bryan, Clifford and Taylor, Joan P. Manual of Respiratory Therapy. St. Louis: C. V. Mosby Company, Inc., 1973.

Cherniack, Rueben M., Cherniack, Louis, and Naimark, Arnold. Respiration In Health and Disease. 2nd ed. Philadelphia: W. B. Saunders Co., 1972.

Hammond, Carl, A.R.I.T. Inhalation Therapy Review Outline. 2nd ed. Washtenaw Community College.

Petty, Thomas L. Intensive and Rehabilitative Respiratory Care. 2nd ed. Philadelphia: Lea and Febiger, 1974.

Safar, Peter, M.D., ed. Respiratory Therapy. 2nd ed. Philadelphia: F. A. Davis Co., 1965.

Sykes, M. K., et. al. Respiratory Failure. 3rd ed. Oxford: Blackwell Scientific Publications.

PERFORMANCE SKILL OBJECTIVES

I. Demonstrate the coughing technique that should be used for a post-operative patient. (Bryan and Taylor, 115-116)

   A. Support patient's lower thorax bilaterally with hands

   B. Instruct patient to inspire slowly and fully

   C. When patient's inspiration is at its peak, exert a slight pressure with hands to begin the cough

   D. Continue compression to increase force and velocity of exhaled air

II. Demonstrate methods by which to splint the surgical wound of a post-operative patient. (M.D.s and therapists)

   A. Place a pillow over the area of wound and exert slight pressure

   B. Hold the wound together by exerting slight pressure inward on both sides of sutures

III. Demonstrate the coughing technique that should be used for a post-ventilator patient. (Bryan and Taylor, 115-116)

   A. Instruct patient to inspire slowly and begin his cough from the mid-inspiratory position

   B. Instruct patient to exhale from the above position in a rapid series of short sharp coughs

IV. Demonstrate the coughing technique that should be used for a patient with chronic obstructive lung disease. (Bryan and Taylor, 115-116)

   A. Instruct patient to inspire slowly and begin his cough from the mid-inspiratory position

   B. Instruct patient to exhale from above position in a rapid series of short sharp coughs

Fig. 11. Continued

V. Demonstrate the method used to relieve an episode of acute air trapping. (Bryan and Taylor, 115-116)

A. Immediately place both hands or arms over the lateral costal margins of the patient

B. Exert a series of strong, short compressions to facilitate completion of expiration

VI. Demonstrate techniques of producing a cough. (Safar, 229-230; Sykes, 87)

A. Depression of supramanubrial notch

B. Using chest physical therapy, Ambu bag, and manual thoraco-abdominal compression

C. Pharyngeal suctioning

D. Transtracheal injection

SUGGESTED LEARNING ACTIVITIES

I. Complete required readings

II. Self-tests

III. Observe and assist the instructor during coughing of patients having different therapeutic needs

IV. Practice coughing techniques on other students

V. Inspect splints on the surgical wounds of post-operative patients

VI. Practice communication techniques

VII. Discussion with the instructor, other health care personnel, and students

VIII. Videotape: Postural Drainage

IX. Videotape: Instruct Patient in Breathing Techniques

X. Videotape: Coughing as an Aid in the Removal of Secretions

COGNITIVE EXAMINATION FOR COUGHING AS AN AID IN THE REMOVAL OF SECRETIONS

1. Briefly state the definition of a cough and indicate the reason for its importance.

2. Briefly explain the mechanism of nervous stimulation leading to a cough.

3. Briefly describe the location of various nerve endings participating in cough stimulation.

4. List four ways in which a cough may normally be stimulated.

   1.

   2.

   3.

   4.

5. List the four phases of a cough and in a sentence or less explain each phase.

Phase	Explanation
1.	
2.	
3.	
4.	

Fig. 11. Continued

6. Briefly describe the role of the diaphragm in a cough.

7. Indicate five common faults of voluntary coughing.

1.

2.

3.

4.

5.

8. List three ways in which coughs may be produced manually.

1.

2.

3.

9. Briefly describe how an incorrectly performed cough may produce an episode of acute air trapping in a patient with chronic obstructive lung disease.

10. Briefly describe the reason assistance with coughing is needed in each of the following types of patients.

Patient(s) TYPE	REASON FOR ASSISTANCE WITH COUGHING
1. Post-operative or post-traumatic pulmonary resection patients	
2. Patients exhibiting post-ventilator weakness	
3. Patients with chronic obstructive lung disease	

11. Briefly indicate the difference in coughing techniques used for the following types of patients

Patient(s) TYPE	COUGHING TECHNIQUES
1. Post-operative or post-traumatic pulmonary resection patients	
2. Patients exhibiting post-ventilator weakness	
3. Patients with chronic obstructive lung disease	

Fig. 11. Continued

PERFORMANCE EXAMINATION FOR COUGHING
AS AN AID IN THE REMOVAL OF SECRETIONS

I. The student will demonstrate the following coughing techniques used for a post-operative patient.

A. Support patient's lower thorax bilaterally with hands

B. Instruct patient to inspire slowly and fully

C. When patient's inspiration is at its peak, exert a slight pressure with hands to begin the cough

D. Continue compression to increase force and velocity of exhaled air.

II. The student will demonstrate the following methods to splint the surgical wound of a post-operative patient.

A. Place a pillow over the area of wound and exert slight pressure

B. Hold the wound together by exerting slight pressure inward on both sides of sutures

III. The student will demonstrate the following coughing techniques that should be used for a post-ventilator patient.

A. Instruct patient to inspire slowly and begin his cough from the mid-inspiratory position

B. Instruct patient to exhale from the above position in a rapid series of short sharp coughs

IV. The student will demonstrate the following coughing techniques that should be used for a patient with chronic obstructive lung disease.

A. Instruct patient to inspire slowly and begin his cough from the mid-inspiratory position

B. Instruct patient to exhale from above position in a rapid series of short sharp coughs

V. The student will demonstrate the following method used to relieve an episode of acute air trapping.

A. Immediately place both hands or arms over the lateral costal margins of the patient

B. Exert a series of strong, short compressions to facilitate completion of expiration

VI. The student will demonstrate the following techniques of producing a cough. (Safar, 229-230; Sykes, 87)

A. Depression of supramanubrial notch

B. Using chest physical therapy, Ambu bag, and manual thoracoabdominal compression

C. Pharyngeal suctioning

D. Transtracheal injection

CHAPTER 4

ASSESSMENT OF COMPETENCE

Assessment is usually equated with examinations, and about these devices Bryant[1] has said:

> "Examinations are among the least understood and most misused tools of education. They are used mainly to certify that the student has learned an acceptable amount of what he has been taught and to provide a grade representing that attainment. While the announced objectives of the institution may be to develop the knowledge, skills, and attitudes necessary to being a good physician or nurse, the examinations seldom measure more than the simple recall of isolated pieces of information. The student's grade is usually determined by comparing his performance with the class as a whole, that is 'grading on the curve', rather than grading according to standards carefully developed by the faculty... The examination system is a dominant force in the setting for learning."

Such a powerful force deserves careful attention in any educational programme, but its harnessing is particularly important in one which has competence as the goal, uses mastery as the method, eliminates time as a programme constant, and encourages the employment of varied resources for learning. For in such a programme the end-point comes only when assessment indicates that the competence goal has been achieved *(summative assessment)*. The speed of that achievement is determined in part by the effectiveness of a diagnostic examination system *(formative assessment)* used to identify student strengths and weaknesses in the course of study so that deficiencies may be promptly corrected rather than allowing further study to do no more than refine what has already been learned. The pace at which the competency goal is attained is also influenced by where each student starts and thus *entry assessment* is essential if wasteful repetition is to be avoided. Each of these elements will be taken up in turn.

[1] BRYANT, J. *Health and the developing world.* Ithaca, NY, Cornell University Press, 1969, pp. 209-210.

ENTRY ASSESSMENT

The effectiveness of an educational programme depends to a great degree on the learning students bring with them to the classroom, clinic, or laboratory. This influence on the cumulative effect of schooling is so strong that Ausubel[1] has asserted: "If I had to reduce all of educational psychology to just one principle, I would say this: the most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly."

Although never explicitly defended in those terms, the almost universal establishment of academic achievement prerequisites for admission to medical school is intended as an assessment of readiness for further study. In some countries this level is set politically, so that all graduates of a secondary school, for example, are eligible for admission to any university faculty. In other countries the criteria are determined by teaching staff who may rule that only those whose prior achievement is, for example, in the top 20% of a secondary-school-leaving examination will be considered for admission. In still other countries not only past academic achievement, but present academic aptitude, as measured by standardized tests, may be considered in determining readiness for the study of medicine. And in at least one country the judgement of peers in a community work setting has replaced the usual academic criteria for admission to medical school.

Each of these methods serves a purpose, but not necessarily the purpose of identifying which students are best prepared to embark on a programme with defined professional competency goals. The open admission technique ensures a broad opportunity for social advancement through education, but it says little about readiness for advanced learning. Countries that employ the method generally have high student failure rates in the early years of university education. The past achievement and present aptitude procedures ensure a high level of success in further academic study, but there is virtually no evidence that this readiness for traditional course work has any significant correlation with the quality of later medical practice.[2–4] The community choice method ensures admission of those with socially desirable attitudes toward the responsibilities for health care which a professional should possess, but whether this indicates a readiness to acquire the professional

[1] AUSUBEL, D. P. *Educational psychology: a cognitive view.* New York, NY, Holt, Rinehart & Winston, 1968.

[2] PETERSON, O. L. ET AL. An analytical study of North Carolina general practice. *Journal of medical education,* **31** (Dec. suppl.): 61 (1956).

[3] PRICE, P. B. ET AL. *Measurement and predictors of physician performance.* Salt Lake City, UT, LLR Press, 1963.

[4] CLUTE, K. F. *The general practitioner.* Toronto, University of Toronto Press, 1963.

competence that must accompany those attitudes remains to be demonstrated.

The problem with all these techniques is quite simply that they are based upon the assumption that past achievement in an academic or work setting is a suitable predictor of ability to acquire a professional competence that has not been precisely defined. There is no question that past performance is the best predictor of future performance of the same kind of task, but if that future task must be different, then such assessments of readiness to learn may be misleading—or even wrong. Yet some technique must be employed to select from a large pool of candidates those who will be admitted to medical school. As preliminary screening procedures, and with the reservations noted, these techniques can certainly be employed, for it is clear that they serve social as well as educational purposes.

A more focused use of entry assessment is intended to facilitate the design and implementation of individualized learning opportunities for those selected. Although not often used, the technique for doing so is conceptually simple and direct: administration of terminal assessment at the beginning of a programme, allowing the results to determine the subsequent course of study. In some instances entry testing may cover an entire year of instruction. Those students who are successful may then begin work at the next year's level. In other instances it may cover only the competencies of a single course, and if their achievement can be demonstrated before enrolment then that course may be omitted. Or to use the respiratory therapy curriculum cited in the preceding chapter as an illustration, each unit might begin with the final examination of knowledge and skills so that further repetitious study would not be devoted to objectives that had already been achieved.

Entry assessment of this kind is particularly important if there is to be real opportunity for professional mobility unimpeded by rigid academic requirements. For example, Table 8 shows the conventional specifications for education of health personnel. It emphasizes the site in which learning should be acquired, and the time that must be given to formal schooling in order to qualify for each rank. However, if the purpose of education is to assure achievement of a defined level of competence, then rationality dictates that assessment of competence rather than time and place of training should determine the placement of an individual in the hierarchy of rank and responsibility. If, through field work and independent study, a graded dresser has gained the competence that characterizes a medical assistant, promotion to that rank would seem logical whether the specified years of secondary education have been completed or not. Or a medical assistant may be able to demonstrate, through entry assessment, proficiency in a

TABLE 8. AN EDUCATIONAL AND PROFESSIONAL CONTINUUM FOR TWO HEALTH PROFESSIONS[a]

Status	Grade	Education		Health professions	
		Form of schooling	Years of schooling	Medicine	Administration
Professional	Specialist	University education—international status	14	Specialist physician	Hospital superintendent
	Medical officer			Medical officer	
Quasi professional	Paramedical	Secondary education—international status	12		
Auxiliary	Senior	Secondary education	10-12	Clinical assistant	Assistant superintendent
	Middle		8–10	Medical or hospital assistant	Storeman and clerk
	Junior		6–8	Graded dresser	
Labourer	Unskilled	Primary education or none at all	0–6	Ungraded dresser	Cleaner

[a] Adapted from: KING, M., ed. *Medical care in developing countries*, section 7:2, Table 2, Nairobi, Oxford University Press, 1966.

significant number of the competencies required for a clinical assistant's post. Under such circumstances an educational programme designed to complete the required repertoire of competencies rather than one to fulfil conventional time and place requirements for that education would seem reasonable, as well as more economical.

Finally, entry assessment is more than a useful placement device for students. It can also be a chastening experience for teachers who are generally inclined to assume that if students demonstrate required competency at the end of a course it reflects the quality of instruction received. When entry assessment is made many teachers may have the kind of painful but illuminating discovery experienced in one department of medicine[1] where "one-third of the students who entered the medical clerkship... achieved on the pre-test a passing grade when judged by standards used in previous years..." And further: "...the pre-test scores of many students were substantially higher than the post-test scores of some of their classmates". What an appalling waste

[1] CENTER FOR EDUCATIONAL DEVELOPMENT. A study of the junior clerkship in medicine. In: *Report to the Faculty, 1963-64*, University of Illinois College of Medicine, 1964 (multilith).

of time, effort, and money to demand continued exposure of students to routine instruction when they have already achieved the objectives! But unless teachers know this—and act upon it—such demands will continue. A competency-based curriculum, using entry assessment, is designed among other things to prevent that waste.

FORMATIVE ASSESSMENT

When education aims at mastery of specifically identified professional competencies the process cannot be allowed to proceed blindly if it is to be efficient and economical as well as effective. In the last quarter of the twentieth century it would be unthinkable to attempt a long journey by car without map or road signs, using merely a compass as a guide. And it would be madness to attempt a journey to the moon without an elaborate and secure guidance system. Yet in schools for the health professions throughout the world students travel a complex educational path with very few, and often ambiguous, guideposts. They usually learn only at the time of final examinations if they have missed the goal. Formative assessment—a system of non-judgemental guidance examinations—is a powerful tool that may be used to forestall such tragic outcomes.

Like the entry assessment that precedes it, and the summative assessment that follows, formative assessment takes as the point of reference competencies that have been defined as educational goals of the programme. And like the other two components of an overall evaluation scheme, formative assessment must employ many testing methods. The major difference among these stages lies in the use of the data gathered. In entry testing the major purpose is to ensure that students are placed at a level compatible with learning already achieved, and to facilitate planning for further study directed towards competencies not yet achieved. Summative assessment is simply a terminal judgement of whether overall mastery has or has not been accomplished. Formative assessment serves the student directly, providing personal and private information on what has been learned and what has yet to be learned. Incidentally, it may also allow teachers to identify areas where many students are encountering difficulty, and thus need perceptive help from staff if those difficulties are to be resolved and the learning objectives are to be achieved by all. Formative assessment is wholly non-judgemental; it is for guidance only. But if this guidance purpose is to be fulfilled, one potential problem must be dealt with directly upon institution of such a system, and reinforced regularly by the teacher's behaviour. This is the issue of trust.

Students have been thoroughly conditioned by past experience to believe that tests are used to judge and to grade them. For many it may be inconceivable that teachers would give tests that "don't count". Yet it is precisely this spirit that must dominate a system of diagnostic examinations. It may take time as well as considerable effort to convince students that such tests are truly given to facilitate their learning directly, or indirectly by helping faculty to identify ways in which that learning can be enhanced. The system will fail unless students come to believe this. They must fully accept as fact any policy statement that data from diagnostic examinations are used solely for educational purposes and not surreptitiously entered into some permanent record that is used for grading. And nothing will precipitate failure more rapidly than violation of trust once it has been established. It is a fragile and precious thing.

Once the principle of formative assessment has been accepted, and the trust issue dealt with, the practical question arises: how often should such diagnostic, non-judgemental examinations be given? At the end of each lecture, clinic or laboratory session? Each unit of related instructional experiences? Each year of an extended educational programme? Or with some arbitrary frequency such as every week? There is no final answer, except in the most general terms. Diagnostic assessment should be carried out with sufficient frequency and regularity to enable results to guide further study of things not yet learned, but not with such frequency as to exhaust either the student body or the teachers. If diagnostic examinations are given infrequently, irregularly, or only at the end of large instructional blocks, deficiencies may be identified but the opportunity to correct them is frequently lost.

The reader may have concluded from these words that teachers alone will determine when diagnostic examinations will be given. Teaching staff must certainly play an important part in this decision, but to leave the responsibility with them alone will defeat one of the important elements of a competency-based curriculum which uses mastery as an instructional strategy: the opportunity for individual pacing. If this is to be provided then the instruments for formative assessment must be available when individual students are ready to use them, not merely when teachers are prepared to administer diagnostic examinations to an entire group. Thus emerges the concept of self-testing, in which students have access to diagnostic examinations in much the same way that they have access to books and journals, to be used at their convenience, to serve their purposes, and without any requirement of supervision by teachers.

A library of books is now such a familiar resource for independent learning that no institution that claims to offer higher or professional education can exist without one. During the last decade library

collections have been expanded in many parts of the world to include nonprint material—audio and video devices that supplement and complement printed works as aids to learning. An institution that adopts mastery learning aimed at competency objectives needs a further expansion of its library collection to include an array of self-testing devices which is as rich and varied as the collection of textbooks, reference works, and professional journals.

The key words here are "rich and varied". A collection of tests which probe only the "simple recall of isolated pieces of information" decried by Bryant will impede rather than foster the curriculum's formative assessment needs by diverting attention from the professional tasks of problem-solving and technical skills of patient management to the academic game of absorbing information without perceived purpose. This does not mean that conventional devices such as multiple-choice tests are inappropriate; it merely means that they must be designed to explore what has been defined in the competency objectives, not simply the information that underlies those goals.

For example, respiratory illnesses represent the commonest group of disorders for which patients in most of the developed world consult a physician. The competency objectives for dealing with these disorders, as outlined by the Royal College of General Practitioners in the United Kingdom,[1] include the ability to distinguish between the transient and the life-threatening disorders of the respiratory tract, and to treat all the common disorders except pulmonary tuberculosis and those requiring surgery (a list of these conditions is set forth in Fig. 12). If achievement of these goals is to be assessed in formative self-tests it will not be enough to ask students to list the signs and symptoms of the diseases (which they could then check against a master listing), or to select appropriate treatment strategies in an objective examination (which could then be compared with an answer key). An accurate formative assessment would require a series of problem-solving tests that probed the ability to discriminate among the diseases as they might be manifested in ambulatory patients, and to deal with the clinical problems as they evolved under whatever management was selected. This is not the place to describe such test procedures, but merely to indicate that many testing methods must be included in a library of formative assessment devices designed to assist students in identifying what they still have to learn.

SUMMATIVE ASSESSMENT

If a formative examination system is wisely used only the rare student will arrive at the stage of summative assessment—that final judgement

[1] Royal College of General Practitioners. *The future general practitioner.* London, 1972.

FIG. 12. PULMONARY DISORDERS, EXCEPT PULMONARY TUBERCULOSIS AND DISORDERS REQUIRING SURGERY, AS LISTED BY THE ROYAL COLLEGE OF GENERAL PRACTITIONERS

460-519 GROUP VIII. DISEASES OF THE RESPIRATORY SYSTEM

This is the commonest group of disorders. It accounts for 650 patients consulting in an average practice population per year.

Common occurrence is its first claim on the teacher's attention. A second is that a small number of possible symptoms, notably cough, may in different people at different times represent a wide range of severity of disorder; transient infections, or recurrent and chronic disorders like bronchitis, or conditions like pulmonary tuberculosis and carcinoma of the lung which, if they are not to threaten life, need to be detected at an early stage, before they have produced physical signs. The group is therefore an excellent example for teaching the need and methods for distinguishing serious from trivial disorders. A third claim is that the chronic diseases, asthma and bronchitis (especially the former), are good examples of the need to assess carefully each individual sufferer, if treatment is to be effective.

Acute respiratory diseases threatening life

Laryngitis in children; bronchiolitis in children; influenzal pneumonia (the rare overwhelming infection); bronchopneumonia; acute on chronic bronchitis; asthma. (Pulmonary tuberculosis is listed under infective, bronchial carcinoma under neoplastic disorders in the appropriate sections).

Diseases which may be aborted, or of which the complications may be reduced through early detection

Recurrent bronchitis, pneumococcal pneumonia, bronchiectasis.

A condition not otherwise dangerous which has dangerous complications

Influenza.

The common disorders in the group are:—

460 Acute nasopharyngitis (common cold)
461 Acute sinusitis
462 Acute pharyngitis
463 Acute tonsillitis
464 Acute laryngitis and tracheitis
466 Acute bronchitis and bronchiolitis
470 Influenza
471-2 Influenza with pneumonia or other respiratory complication
473 Influenza with digestive manifestations
480 Viral pneumonia
481 Pneumococcal pneumonia
482 Other bacterial pneumoniae
485 Bronchopneumonia
490 Bronchitis
491 Chronic bronchitis
492 Emphysema
493 Asthma
500 Hypertrophy of tonsils and adenoids
501 Peritonsillar abscess
503 Chronic sinusitis
505 Nasal polyposis
507 Hay fever
511 Pleurisy
512 Spontaneous pneumothorax
518 Bronchiectasis

Bornholm disease appears among the infective disorders.

Chronic conditions requiring continuing care

Asthma, chronic bronchitis and emphysema, hay fever, bronchiectasis.

[a] ROYAL COLLEGE OF GENERAL PRACTITIONERS. *The future general practitioner.* London, 1972 (reproduced by permission).

of whether the competency objectives have been achieved—and be unable to succeed. Failure of any significant number will reflect as much on the quality of the programme as on the quality of individual learning. But if students fail in their ability to demonstrate the required professional competence there must be no hesitation in making that harsh judgement, for this is the quality-control point, the means by which an institution asserts that a graduate is qualified to render a defined professional service. Students may have started from different points, and have spent varying periods of time in study, but all who are successful in meeting the requirements of summative assessment must have achieved that defined level of competence.

With this in mind it must be clear that the common normative procedure for determining success will not do. Such a method identifies

TABLE 9. OBJECTIVES OF A MEDICINE RESIDENCY [a]

Definitions:

1. *Concepts:* deal primarily with disease entities or syndromes; knowledge of a concept implies ability to diagnose, treat, and understand the basic mechanisms of the disease or syndrome under consideration, and to be familiar with its preventative, medicolegal, disability and public health aspects.
2. *Skills:* relate to ability to properly order, perform and interpret certain specific technical procedures.
3. *Attitudes:* include behavioral characteristics, value judgments and doctor-patient relationships.

Degree of Expertise – Classification:

	Concept	*Skill*
Category I	Is able to carry out all medical phases of diagnosis and management without consultation in 90% of cases. Consultation for technical procedures may be necessary.	Is able to recognize need for, perform, and interpret procedure without consultation in 90% of cases.
Category II	Usually needs consultation (other than for technical procedures) at some point in managing the patient with this disease, but is able to maintain primary responsibility for the patient in 90% of cases.	In 90% of cases is able to recognize the need for and order the procedure, but must obtain consultation to have it performed and/or interpreted.
Category III	In 90% of cases is able to recognize the possibility that this disease exists, but does not maintain primary responsibility for this disease and refers the patient for both diagnosis and management.	Aware of the procedure's existence and general characteristics, but needs consultation to determine the need for, perform and interpret the procedure.

[a] HISS, R. G. & VANSELOW, N. A. Objectives of a residency in internal medicine. *Journal of the Association for Hospital Medical Education,* **4**: 11 (1971) (reprint permission from the Managing Editor, Association for Hospital Medical Education).

TABLE 10. GASTROENTEROLOGY [a]

CONCEPTS

Category I:

1. Achalasia
2. Carcinoma of the colon
3. Carcinoma of the pancreas
4. Carcinoma of the stomach
5. Cholangitis
6. Cholecystitis, cholelithiasis
7. Cirrhosis
8. Cyst of pancreas
9. Diarrhoea, psychophysiologic
10. Diverticulosis and diverticulitis
11. Duodenal ulcer
12. Dysentery, bacterial
13. Gastric ulcer
14. Gastritis
15. Gastroenteritis, viral
16. Haemorrhoids
17. Hepatic coma
18. Hepatitis (SH, IH)
19. Hepatotoxins and toxic hepatitis
20. Hiatal hernia
21. Jaundice, differential diagnosis of
22. Liver, fatty
23. Malnutrition
24. Pancreatitis
25. Peptic oesophagitis
26. Polyps, colonic
27. Polyps, gastric
28. Enteritis, regional
29. Ulcerative colitis, chronic

Category II:

1. Carcinoma of the oesophagus
2. Carcinoma of the small bowel
3. Oesophageal diverticula
4. Oesophageal varices
5. Evaluation of acute abdomen
6. Gastrointestinal enzyme deficiency states
7. Gastrointestinal bleeding, massive
8. Malabsorption, primary and secondary
9. Mesenteric arterial insufficiency
10. Post-operative alimentary complication, delayed (dumping, etc.)
11. Stricture of oesophagus

Category III:

1. Gastrointestinal malformations
2. Other gastrointestinal neoplasms

SKILLS

Category I:

1. Gastric analysis
2. Liver biopsy, percutaneous
3. Paracentesis
4. Sigmoidoscopy with selective biopsy
5. Use of Blakemore-Sengstaken tube

Category II:

1. Barium enema study
2. Cholecystography
3. Oesophagoscopy
4. Gastroscopy
5. Liver scan
6. Pancreatic function tests
7. Selective arteriography
8. Upper gastrointestinal and small bowel series, hypotonic duodenography

Category III:

1. Malabsorption studies
2. Motility studies
3. Peritoneoscopy
4. Small bowel biopsy

[a] HISS, R. G. & VANSELOW, N. A. op cit. (reprint permission from the Managing Editor, Association for Hospital Medical Education).

the successful candidate by reference to the performance of others who have taken the same test or a similar one. The acceptable performance standard may be set in many arbitrary ways, such as not more than 2 standard deviations below the mean of all who have taken the test, or the top 80% of those tested, or all except the lowest 20 in the test group. Whatever the technique, judgement of success is based solely upon the relationship of each individual's performance to that of others, not to some absolute standard.

It is the absolute standard (technically, reference to a criterion) that is required in a competency-based curriculum. If the objectives are categorized, as they have been, for example, in one outline of a training programme in internal medicine (Table 9), then the trainee who can manage without consultation only 60% of the problems in category I, or is unfamiliar with the procedures in category III (Table 10) will fail no matter what the mean score of the group being tested, whether that individual is alone in this deficiency or shares it with half those in the test group. Competence is not a matter of comparison with what others do, it is by definition either achieved or not achieved.

But it is important to point out again that the level of expected competence in dealing with common problems will differ among groups of health personnel who may encounter them, or be responsible in varying degree for their management. For example summative judgements for a midwife and an obstetrician may cover many of the same performance categories, but will require clearly different levels of mastery. In each instance, however, the final judgement in terms of the established criterion would be either mastery achieved or not achieved. There is no middle ground.

CHAPTER 5

PREPARATION OF TEACHERS, STUDENTS AND INSTITUTIONS

Those who endorse the assumptions and purposes of competency-based education must also recognize that implementation will alter the usual modes of institutional operation. Educational activities, record-keeping systems, and time schedules may all have to change, but the most significant modifications will be those of faculty and student attitudes and practices, which must shift in a manner that emphasizes learning rather than teaching. Such changes are not easy to bring about. One prominent student of organizational development has said that "trying to reorganize a university is like trying to reorganize a graveyard".[1] Tyler has noted that even those curriculum changes that show great intitial promise are often abandoned after a few years, largely because of "the institution's failure to make those changes in its structure and functioning that will support and promote, rather than oppose, a dynamic process of curriculum development".[2]

If it is to be lasting, educational change must be regarded as a continuous process of institutional and professional renewal. It has no discernible end-point. It grants tentative acceptance to today's innovations while being committed to improvement tomorrow. It is experimental in the true sense, regarding approaches to learning and teaching, even those that have won long acceptance, as hypotheses worthy of testing rather than as empirical laws. For these reasons two issues will be considered in this final chapter: (1) what new roles for teachers and students are required if a competency-based and mastery-oriented curriculum is undertaken; and (2) what strategies and tactics can an institution employ to reduce barriers and facilitate the adoption of such a plan?

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[1] BENNIS, W. G. *The leaning ivory tower.* San Francisco, CA, Jossey-Bass, 1969.

[2] TYLER, R. W. Curriculum improvement in the university. *Journal of medical education,* 45 (Nov. suppl.): 42 (1970).

NEW EDUCATIONAL ROLES

The teacher

If we look back at the educational process described in earlier chapters, three new roles for teachers can be identified. The first is that of *planner,* probably the most difficult and time-consuming of the functions which must be embraced if a competency-based curriculum is to be successful. Teachers have always been expected to plan their instruction, and often spend long hours doing so. It is not the quantity but the character of the effort which must change.

In a conventional programme the principal focus of planning is on: (1) content—what will be presented to students in lectures, laboratory work, or clinical experience; and (2) time—how much can be won to convey the subject and how shall that time be divided among several different kinds of instruction. In a programme directed at mastery of defined competencies, time becomes a variable that will be determined by individual progress toward the goals; and content, in the sense of subject matter courses, must be replaced by a system of organization that focuses on professional problems whose solution depends on knowledge and skills derived from many disciplines.

The most important of the planning tasks is to define the competencies to which the curriculum must be directed. The next is to plan instructional units that must build systematically and sequentially toward those goals. Methods that might be used in carrying out those functions have been outlined in earlier chapters.

The second new role is that of *manager* of instructional resources. The usual course outlines, which identify lecture topics, reading assignments, laboratory exercises or clinical experience for all students, are incomplete in a competency-based programme. In such a curriculum it is essential to list the specific competency objectives, to indicate the alternative learning resources that are available to assist students toward those objectives, and to define the assessment procedures that can be used to determine individual progress. There must also be an indication of specific time periods when teachers are available to assist individual students or groups in surmounting whatever learning problems they may encounter. In these meetings the teacher's task is to encourage and not to dominate, to guide rather than to tell, to suggest sources rather than to provide directly all the knowledge students must acquire.

The third role is that of *evaluator.* The skill with which this function is carried out will probably be a major determinant of programme success. If students find teachers using examinations primarily to enforce lecture attendance or the completion of specific reading assignments by testing recall of obscure references in the former or fine

print in the latter, then conformity with a predetermined faculty plan is both encouraged and rewarded. If they find teachers genuinely concerned with helping them to assess their own progress toward defined competency goals, no matter what learning path is chosen, and without communicating judgement but merely identifying the nature of that progress, independence and personal responsibility for learning, without which a mastery-based system cannot succeed, will be nurtured.

These new roles are not easy for teachers to adopt when they have themselves been educated in a more conventional way and have developed a style of teaching that is comfortable, as well as consistent with a personal perception of professional responsibility. Yet such personal perceptions are rarely uniform within any medical school. One investigation of the sociology of higher education has identified 4 faculty subcultures:[1]

1. The *teacher* who is committed to students and their welfare, spends many hours teaching, and is impatient with colleagues who devote themselves largely to research or to professional service. This is the individual who is usually popular with students and wins their praise, but who is often regarded by other members of the teaching staff as lacking depth, being unfamiliar with current advances in his discipline, and having more concern for pleasing students than with educating them.
2. The *scholar-researcher* is committed to pure, disinterested study, and regards the pursuit of new knowledge as the unique goal of a university. The teaching function is acknowledged to be significant, but primarily as a means of sharing with students the latest developments in a discipline, the horizons still being explored, and the excitement of an intellectual life. Whether what is communicated to students is immediately relevant to their interests or needs is regarded as relatively unimportant, since it is the process of gaining new understanding rather than immediate application that should be of greatest academic concern.
3. The *demonstrator* has a teaching appointment but basically identifies with the local practitioner community, devoting a major portion of time to the direct delivery of professional services and a lesser amount to more academic pursuits. Such an individual has little opportunity for or inclination towards research, although willing to apply the products of research in practice. Teaching is conducted largely as an exercise in showing apprentices how a master works, and encouraging (or requiring) students to adopt that behaviour without significant question or challenge.
4. The *consultant* is also interested in the application of knowledge, but is more concerned with applications at the conceptual than at the personal delivery level. This is the professional who has achieved a national or international reputation on the basis of prior work, who spends a substantial amount of time in travel, attending or addressing meetings principally made up of others with similar orientation, and who shares these experiences with students in an episodic fashion rather than in continuity.

[1] Feldman, K. A. & Newcomb, T. M. *The impact of college on students.* San Francisco, CA, Jossey-Bass, 1969.

These subcultures rarely exist in pure form but rather represent persuasions or orientations of individual teachers. Each represents a view that may meet some part of the university mission, but none is fully compatible with the requirements of a competency-based curriculum. The mechanism for bringing such teachers to the point of accepting new roles will be dealt with in a later section of this chapter, but first it is necessary to look also at the modifications of student role that such a curriculum will demand.

The student

There appears to be widespread agreement that university students today are more demanding than those of earlier generations. Student militancy, once limited to only a few countries, is now widespread. While the causes may vary from place to place and from time to time a few themes regularly recur whenever students debate the merits and shortcomings of educational programmes.

One has to do with curriculum content. There seem to be few places in the world where learners do not protest against the amount and the irrelevance of the material they are taught. While these criticisms are directed most forcefully at the basic and preclinical sciences, there is also discontent with the growing number of clinical subspecialties in which instruction is given. And there is some reason to believe that instructional content has become so large not because of any evidence that all students will need it in the professional lives for which they are preparing but to satisfy teachers that all have been exposed to the things that are academically important and may at some time be useful. Yet when given the opportunity to choose, as they are in an increasing number of schools with substantial elective programme offerings, students do not regularly select what might better prepare them to serve the society of which they are a part. Instead they often select experiences that will make them more like the teachers who are concerned with serving only a small segment of that society.

Another general complaint relates to the quality of instruction. Since lectures are still the most widespread instructional method in medical education, the feeling probably indicates a major dissatisfaction with this technique, at least as it is currently used. But it also reflects a general sense of alienation between students and teachers, a longing for the personal concern through which the best teachers have always helped students to find their way through the educational maze towards a professional career they discern only dimly. As class sizes increase—a phenomenon that is worldwide—the occasions for these interactions seem to be diminishing steadily. Yet when opportunities are provided teachers are often discouraged by the infrequency with which students

use them. One explanation of this behaviour is that learners have found it safer to go unrecognized, to remain anonymous, for individual exposure may lead to judgement that they are unworthy instead of to the constructive help that will make them more competent.

This highlights a third target for complaint: examinations and grading. The fairness of academic testing is challenged by students in many countries who feel that most tests do not provide an opportunity to demonstrate what they know, and certainly not enough to allow the judgement embodied in a grade. In countries that use only terminal examinations (whether oral, objective, or in essay form), students press for more frequent assessment, while in those with many interim tests the plea is for a reduced number so that time can be spent on meaningful learning rather than preparation for examinations.

These observations might suggest that students would find a competency-based and mastery-oriented curriculum very appealing. It addresses the issue of content and relevance, provides opportunity for independent pacing and alternative sequence, incorporates a variety of learning experiences designed to serve clearly defined competency objectives, employs an assessment system aimed at maximizing the opportunity for all to succeed rather than assigning a grade, and envisages greater commitment by teachers to the facilitation of individual student learning. But what is conceptually appealing is not always operationally comfortable. If this kind of curriculum plan is to succeed, students too must adopt new roles.

One necessary change is abandonment of an adversary position and acceptance of a willingness to join with teachers in thoughtful discussion about learning objectives and instructional strategies. Just as the teaching staff must use new sources to determine educational goals that are consistent with community needs, so must students learn that their personal opinions must be replaced by systematic delineation of the competencies to be acquired. Demands for a stronger voice in planning will probably produce a favourable response from teachers only when students show willingness to engage in a disciplined examination of alternatives, not merely emotional espousal of beliefs.

A second change will require students to accept the personal responsibility for learning that is a central component of the competency-based system. Although they may complain about inflexibility, students have been so conditioned to fixed class schedules, and to accumulating lecture notes from which to study for final examinations on which they will be graded, that being faced with options instead of schedules, making choices rather than following directions, and revealing ignorance in order to learn rather than concealing it in order to get a high grade will all create anxieties that may initially be even greater than those they now feel.

If these are the role changes that a competency-based curriculum requires, how can they be brought about?

STRATEGIES FOR CURRICULUM CHANGE

Behavioural scientists have identified 3 principal methods through which educational changes are accomplished, either by design or by accident: power, rationality and re-education.

Power

Strategies based on power are the most common, and most rapid, means of producing any alteration in educational programmes. A vice-chancellor or a dean may in some institutions identify a programme goal, mobilize the resources that such a position controls, and in relatively short order institute something new. More commonly this power is vested not in a single individual but in a group of department heads who negotiate with one another like leaders of sovereign states. Within their empires, individual decisions about programme policies and procedures are absolute. Teachers and students may have reservations about the modifications proposed by such authorities and may even voice their concern, but in the end it is the power figures who make the decision after winning the support of colleagues or having decided to proceed despite opposition.

While this method is effective there is a real question as to whether it is efficient or lasting. The following illustration is taken from public education in a developing country where sleeping sickne s was endemic:[1]

> "Field surveys showed that in some areas up to 40% of the inhabitants had the disease. Tests revealed that the disease could be controlled by cutting the brush along the streams in which the tsetse fly, the carrier of the disease, bred. The people disbelieved that sleeping sickness was carried by the fly. Moreover, they regarded certain patches of brush along the stream as sacred and inhabited by spirits who would be angry if their abodes were disturbed. The clearing of the brush was successfully carried out only when pressure was applied by . . . officials through the traditional framework of native authority. While the disease was virtually eliminated, the . . . people never associated this fact with the cutting of the brush. This was a measure imposed upon them by force from higher authority. Inasmuch as this practice was not incorporated in their cultural system, there were strong indications that this activity would discontinue after the withdrawal of [official enforcement]."

[1] MINER, H. Culture change under pressure : a Hausa case. *Human Organization*, **19**: 161 (1960). Abridged in: BENNIS, W. G. ET AL., ed. *The planning of change*. New York, NY, Holt, Rinehart & Winston, 1969.

If a change in educational programming is to be real and lasting it must, like preventive medicine, be worked by more than the power of leaders. They may be able to establish the appearance of change, but the teachers who control classrooms ultimately determine the spirit of what goes on there. Without their full understanding and support, what looks admirably different in form may prove in substance to be no more than old wine in new flasks.

Rationality

Empirical-rational methods for educational programme change should be particularly appealing to an academic community of scholars, for they embody the principles that presumably undergird the whole structure of higher education. Certainly they have flourished in the contemporary world of university research. The proponents of this strategy can be expected to assemble supporting data, investigate alternatives, and through dispassionate reasoning produce a recommendation that is itself open to further modification on the basis of experience or experimentation. This orientation led a planning group in one medical school attempting to establish the basic objectives for a competency-based curriculum to seek the opinion of many individuals before culling the findings and making a rational appeal to colleagues:[1]

> "The subcommittee majority forwarding this document has no expectation that it will be acceptable to all. The members are agreed that the objectives outlined here require further discussion, extension, elaboration, and even excision of some items by a larger sample of the faculty. They can only note that what is included represents more than the personal views of eight people—it is the distillation of ideas contributed by nearly 300 faculty members, 50 practitioners in various settings, some 40 senior students, and others who have recorded opinions or information in the literature of medicine. While they believe that the general content of objectives is both appropriate and substantively sound, they are neither willing nor prepared to defend each item; but they do insist that the kind of specificity illustrated here is essential if the final document is to be more than a collection of appealing generalities".

The proposal that accompanied this recommendation, like so many others that have focused attention on the basic competencies required in those who will render much needed primary care, encountered attack almost immediately. Although it could not on rational grounds be assailed as inappropriate, it was rejected by those with special interests as being incomplete. The document was concerned with the issue of identifying a minimal competence expected of all students, and it gave little attention to things required beyond that minimum. Those who at

[1] Abraham Lincoln School of Medicine Subcommittee on Objectives. *Report to the Committee on Instruction.* Chicago, University of Illinois College of Medicine, 1970 (multilith).

heart rejected the rational premise upon which it was built found in this omission a reason for withholding their endorsement.

While any proposal that omits logic and reason is suspect, it is essential to remember that logic alone rarely produces significant change: the psychological needs of the teachers and students whose support is required must also be dealt with. The third strategy attempts to encompass both.

Re-education

The position taken by advocates of this strategy is captured in these words:[1]

> "Change in a pattern of practice or action ... will occur only as the persons involved are brought to change their ... orientations to old patterns and develop commitments to new ones ... [These] involve changes in attitudes, values, skills, and significant relationships, not just changes in knowledge, information or intellectual rationales for action and practice".

It is no small task to work such change; and, before beginning, those who undertake it should recognize the ingredients essential to success. They fall into two major categories: things that hinder and those that nurture the learning that will lead to new educational patterns. Many scholarly volumes and practical guidebooks have already been written on these topics; this monograph can do no more than identify the issues that must be considered.

Among the *barriers* to re-education of teaching staff and students, 4 are particularly prominent:

(1) *Inertia.* The physical law that describes "the tendency of a body when at rest to remain at rest, and when in motion to remain in motion until acted upon by some outside force" is equally applicable to formal education. It is much easier to go on "teaching" than to learn how to become a "planner", "manager", or "evaluator", and teachers are remarkably skilful in finding persuasive reasons for avoiding even intellectually desirable things that are emotionally unappealing.

The frustration such passive resistance generates in reformers sometimes leads them to attempt to achieve change through the exercise of power. But the most powerful stimulant to sustained change is one of helping learners (whether they are teachers or students) to discover that change to a new pattern of behaviour will serve them better than

[1] CHIN, R. & BENNE, K. D. General strategies for effecting changes in human systems. In: BENNIS, W. G. ET AL., ed. *The planning of change*, New York, NY, Holt, Rinehart & Winston, 1969.

preservation of the old. Since both teachers and students are invariably dissatisfied in some way with the educational programmes in which they are participants, the skilful agent of change will use these dissatisfactions as the point of entry for joint determination of how things might be modified. Once their attention has been captured it is easier to guide them towards new data, or to authoritative sources that can provide a suitable rationale for change.

(2) But if this is to be accomplished, leaders must scrupulously avoid the barrier that is created by *aggressive action.* Change agents often become their own worst enemies by exhibiting impatience with the slow pace of progress toward a new plan. One perceptive observer has pointed out:[1]

> "... we should not strive too much for speed in mental activities. To get speed we have to keep the same patterns of thought; and if we keep the same unchanging patterns of thought we renounce all possibility of being original and creative ... We should not feel stupid if we cannot understand—let alone accept—a new idea or theory. It takes time to disconnect our habitual nerve cell patterns and reconnect them in a different order".

Internalization of a new idea to the point of modifying behaviour cannot be hurried by pressure or coercion. An astute leader will instead highlight even small gains while encouraging the more difficult steps that remain to be taken.

But the facilitator must also show personal willingness to change course if open discussion and exploration of alternatives identify a better path. To behave like a zealot, demanding unswerving adherence to a single view, will arouse hostility and resistance instead of fostering the spirit of cooperation that is essential to successful implementation of a competency-based programme.

(3) There will inevitably be barriers created by *priority conflicts.* Teaching staff in many medical schools point out that personal progress in an academic career depends first on productive scholarship (by which they usually mean publication), and secondly on developing some unique skill in delivering direct patient care. Thus it should come as no surprise if these activities take priority over learning how to become the educational "planners", "managers", or "evaluators" who are required to establish a competency-based curriculum. Those who press teachers to accept these new educational tasks as a high priority must somehow deal with what those staff members may perceive as a different reality.

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[1] Boss, J. S. *Art of awareness,* 2nd ed., Dubuque, IA, Wm. C. Brown, 1973.

(4) But the most important barrier is probably *territoriality*. Medical schools in most countries have developed as a collection of virtually independent units called departments or institutes. Faculty organization is loose and administrative responsibility is commonly assigned to a dean who has little authority, is a temporary occupant of the post, and is seen as a presiding officer rather than a decisive leader. Without a more effective system of checks and balances governing departmental autonomy than now exists in all but a handful of institutions, introduction of any school-wide curriculum change is nearly impossible since each component unit has what amounts to veto power. Asking department heads to relinquish some of that authority is unlikely to produce anything more than resistance. Thus an early part of any re-education strategy must be directed toward the dominant figures, who may see only an erosion of their power in a competency-based curriculum. Winning the support of at least a significant segment of that leadership group is essential if educational programme change is to be substantive, not merely cosmetic.

Many readers may wonder why limited resources have not been cited as an important barrier to change. The reason can be simply stated: the greatest impediments are found in the heart, not in the purse. In this volume illustrations from developing countries have been used not only as a means of keeping the focus on the sites of greatest need, but also to show that where there is a will a way can be found, no matter how limited the resources. It is unquestionably true that some kinds of change may demand funding or personnel beyond the reach of some nations, and others would be easier if additional resources were available. But it is also true that even the richest countries have experienced difficulty in establishing educational programmes in medicine that are directed at national health service needs rather than the traditional production of conventional health personnel. External constraints, of which inadequate resources are one, cannot be ignored. But, as someone once said, "even in a strait-jacket, there is room for some movement".

Aids

What, then, of the obverse, the methods available to facilitate new kinds of programme development?

(1) Anyone trying to understand why teachers behave as they do, or attempting to change that behaviour, would be wise to look first at the *reward system*. If a staff member is recognized for contributions to patient care, then this work is likely to claim the greatest attention; if for

research productivity, this is where effort will first be invested. And to judge from the tales told in all parts of the world, creative work in medical education is the function least likely to bring academic recognition or reward. Changing this order of things will be difficult, but a beginning must be made if such innovations as competency-based curriculum organization and mastery-learning methods are ever to become an integral part of the fabric of modern medical schools.

The responsibility for producing this change lies squarely on the shoulders of medical school leaders. They themselves may not carry out the work, but without their encouragement and support it will never be done—at least not in a way that has lasting impact on a school. Certainly individual teachers or individual department heads here and there have brought about substantial changes in the educational programmes for which they are directly responsible, but without general endorsement by the power structure these changes remain isolated islands in an educational sea that is very different in character. In the face of faculty apathy, as well as the student hostility that eventually focuses on deviant programme methods, the probability is high that such change will vanish, or at the very least will fail to thrive.

(2) For competency-based curriculum efforts there is a growing *extra-institutional* force that may facilitate the development of a supportive institutional value system. This is the force described at the beginning of this volume—a steadily mounting demand from those who provide the funds for medical education, and those who depend on the services delivered by its graduates, to make the educational process more congruent with countries' needs. If national policy-makers reward institutions that respond to these expectations, and institutional policy-makers reward departments and individual teachers who work toward bringing about the necessary programme changes, a process will be set in motion that cannot fail to gain momentum. The danger is that this momentum may become a blind force, directed toward the imposition of a new educational orthodoxy and not the continuing renewal of a data base for perpetual programme review and refinement.

(3) This ever-present danger, as well as the pull of reason, leads directly to the final facilitating factor—*research in education.* A medical school staff must learn how to study the process of medical education, to examine its efficiency and its effectiveness, its costs and its benefits, and to use the findings for further programme improvement. Faith, unsupported opinions, and limited personal experience as a basis for generalization are insufficient in medical education just as they are in health care. Continuous and systematic self-scrutiny is uncomfortable, but it is a method that has brought great strength to medical science.

As one of the cornerstones for competency-based curriculum development it can lend equal strength to medical education. It is surely the most promising tool now at hand for bringing about a better match between education for the health professions and national health service needs.

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